THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXX. No. 738.] LONDON, JULY 3, 1877. [29th Year.] Price 6d.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—12,000 cubic feet of gas per ton of coal; 28-candle gas; coke, 66·70 per cent.; volatile matters, 33·30 per cent. Coke of good quality.

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RAMSAY'S FIRE-CLAY ARTICLES.

GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.

Manufactories—Derwentaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne.

Address G. H. Ramsay, Newcastle-on-Tyne.

GENUINE TORBAY PAINT
AND
SPECIAL GASOMETER PAINT.

Four Prize Medals. Established over 20 Years.

These Paints are now used in 150 Country Gas-Works, and by all the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.

They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations.

The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov.* 2, 1866.

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Works: BRIXHAM, TORBAY.

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BROOKFIELD WORKS,
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SPÉCIALITÉ:
THE MANUFACTURE OF
WOOD GRIDS
FOR
SCRUBBERS
AND
PURIFIERS.

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JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE.

Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."

J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.

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Established at the commencement of Gas Lighting.
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THE OLD PATENT TUBE WORKS, WEDNESBURY.

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FOR THE ENGLISH GOVERNMENT
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Presented by Her Majesty's Government to the French Government,
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Warranted to Measure correctly & not to vary.

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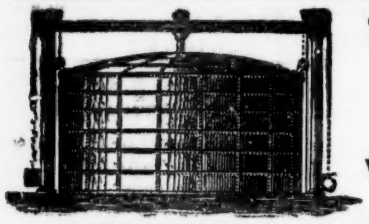
Now ready, GAS CHANDELIER BOOK (Reduced Prices), 7s. 6d.



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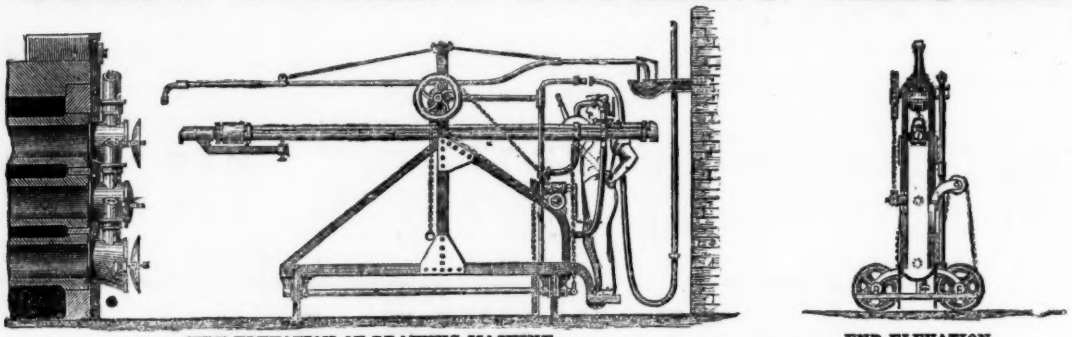

SIDE ELEVATION OF DRAWING MACHINE. END ELEVATION.

(The Charging Machine will be Illustrated in next week's Advertisement.)

Makers: TANGYE BROTHERS and HOLMAN, London and Birmingham; ADAM WOODWARD and SON, Manchester; ROBERT LAIDLAW and SON, Glasgow; MASCHINENBAU-ACTIEN-GESELLSCHAFT HUMBOLDT, Kalk bei Deutz;
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SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 1000 days, and are yet in good order. References on application.

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FOR GAS, STEAM, AND WATER;

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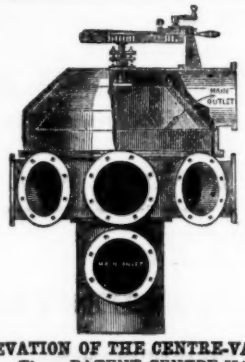
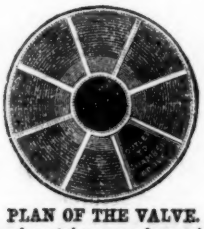
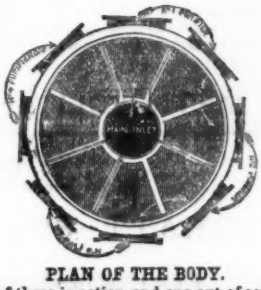
PATENT CENTRE-VALVES.



ELEVATION OF THE CENTRE-VALVE.



PLAN OF THE VALVE.



PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

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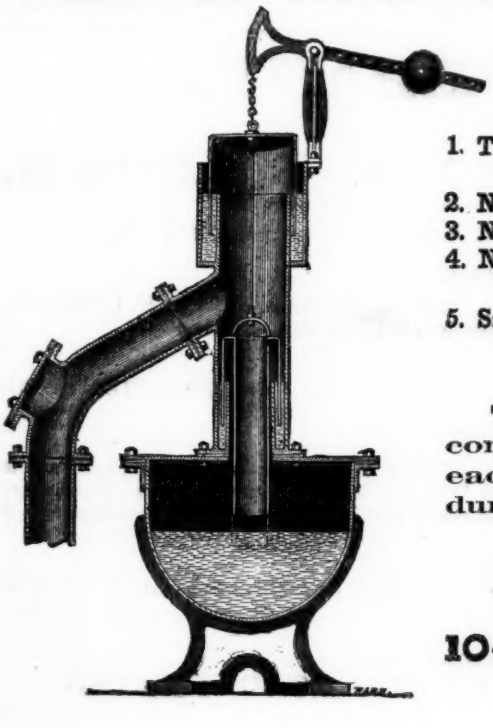
SELF-ACTING REMOVABLE DIP-PIPE,

PATENTED BY

CHANDLER & STEVENSON.



ADVANTAGES.

1. There is no pressure on the Retorts.
2. No deposit of Carbon.
3. No scurfing is required.
4. Never a choked Ascension-Pipe.
5. Saves Fuel and Wear and Tear.
6. Gets 10 per cent. more Gas out of the Coal, and a higher Illuminating Power.
7. Is never out of order.
8. Requires no attention.
9. Is perfectly automatic in its action.

These Dip-Pipes can now be supplied complete, except the flanched bend, for £4 each, which includes the charge for licence during the whole term of the patent.

Applications to be made to

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Who fix the Dip-Pipes, at a small Charge, when required.

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KING'S ROAD, LONDON, N.W.,

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Attention is called to their Dry Meters in Wood Cases, as used by the principal London Gas Companies. These Meters are especially suitable for seaport towns and for export.

The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

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INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

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IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

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And all kinds of Experimental Gas Apparatus.

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EVERY DESCRIPTION OF GAS APPARATUS.

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NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

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They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

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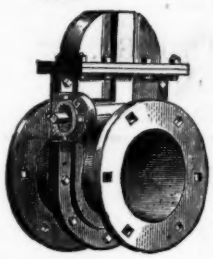
LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.

B. DONKIN & CO.'S

IMPROVED GAS-VALVES

WITH WROUGHT-IRON PINIONS.



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These Valves are proved on both sides to 30 lbs. on the square inch before leaving the works, and are kept in stock.

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ROUND STATION-METERS,

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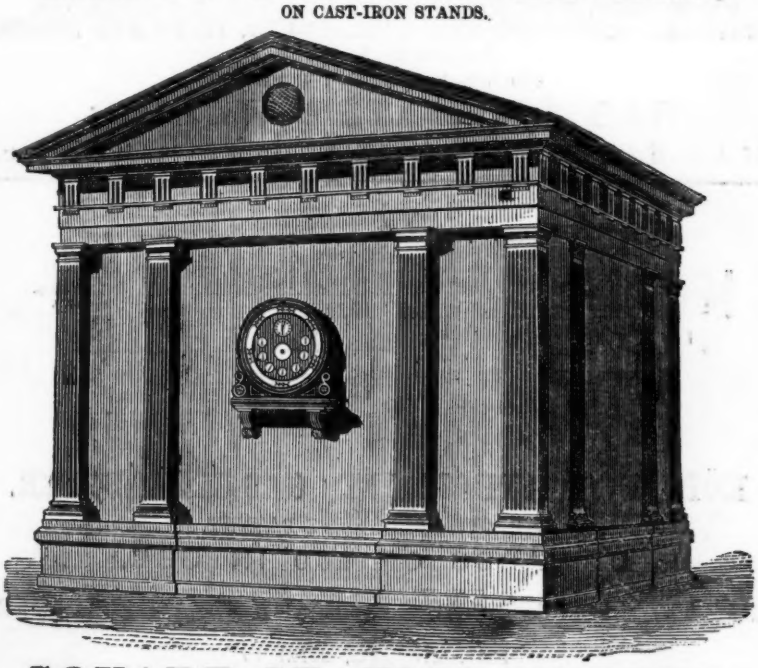

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Home and Foreign Orders promptly attended to.

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Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.
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Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
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BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.
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PROPRIETORS OF THE
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STOURBRIDGE.
Manufacturers of all Descriptions of
BEST STOURBRIDGE FIRE-BRICKS, LUMPS, AND CLAY RETORTS
Of all Dimensions for Gas-Works,
GLASS-HOUSE POTS & CRUCIBLES
Of every kind.
The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture.

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PREVENTS WASTE OF GAS FROM RETORTS;
SAVES CLAY RETORTS FROM DESTRUCTION BY FIRE;
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And PREVENTS ALL POSSIBLE LOSS of GAS FROM LEAKAGE.
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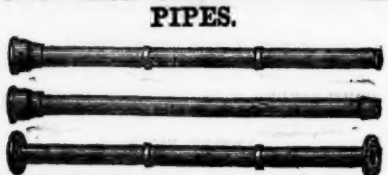
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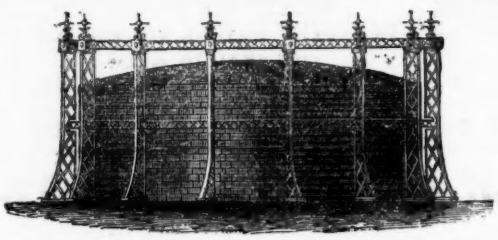
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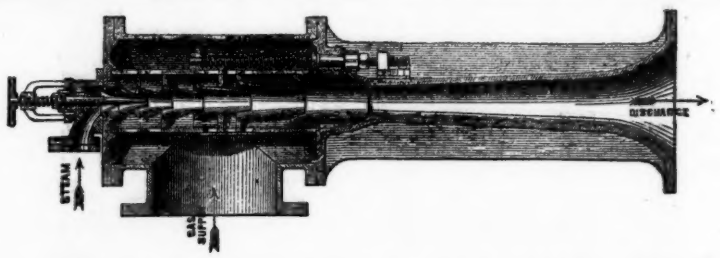
GAS OR WATER WORKS;
ALSO
MAKERS OF ROOFS, BRIDGES, &c.



KÖRTING'S STEAM-JET GAS-EXHAUSTER.
IMPROVED CLELAND'S PATENT.
UPWARDS OF 250 IN USE.
CLELAND'S PATENT CONDENSER AND STEAM SCRUBBER.
FOR PARTICULARS, APPLY TO
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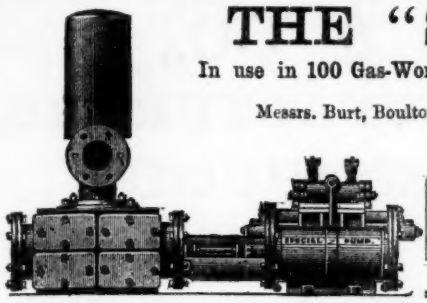


THE "SPECIAL" STEAM-PUMP.

In use in 100 Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

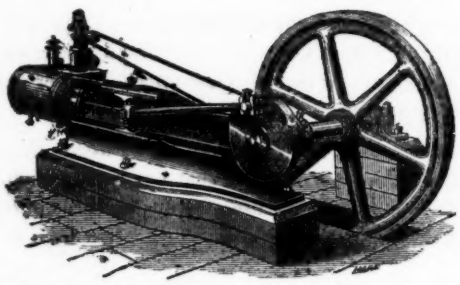
Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have Forty "Special" Steam-Pumps in use at their several large Tar-Works.

200 Sizes made. The following are the Leading Sizes for Gas-Works:—

Steam Cylinder . . .in.	3	4	3	5*	5*	4	6*	5	7*	6	8*	7	10*
Water Cylinder . . .in.	1½	2	3	2¼	3	4	4	5	5	6	6	7	7
Gallons per hour . . .	450	815	1830	1250	1830	3250	3250	5070	5070	7330	7330	9750	9750
Price	£16	£18	£18	£21	£22½	£25	£30	£32½	£40	£40	£50	£50	£65

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HORIZONTAL HIGH-PRESSURE STEAM-ENGINES.



THE DESIGN,
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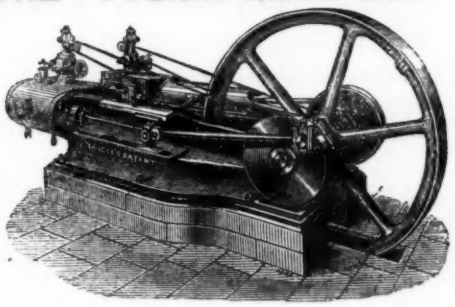
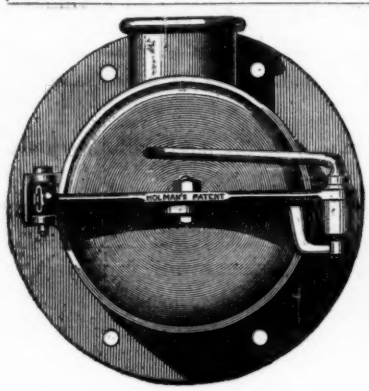
AND
LOW PRICE
OF THESE ENGINES
HAVE CALLED FORTH
UNIVERSAL APPROVAL.

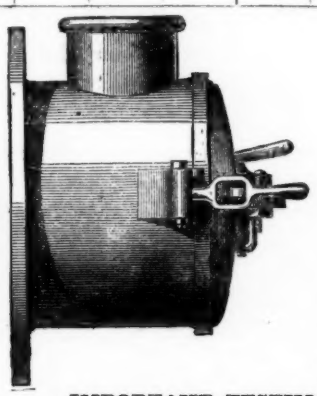
Over 2000 Sold

Since December, 1869.



SIZE	B	C	D	E	G	H	I	J	K	M
Nominal Horse Power	TWO	THREE	FOUR	SIX	EIGHT	TEN	TWELVE	FOURTEEN	EIGHTEEN	TWENTY-FIVE
Price of Engine, with Governor	£38 0	£46 0	£57 0	£70 0	£90 0	£115 0	£127 0	£140 0	£195 0	£220 0
Feed-Pump, extra.	3 0	3 15	4 0	5 10	6 0	7 10	7 10	8 0	10 0	15 0
Variable Expansion Gear, extra	..	..	..	..	13 0	14 0	15 0	15 0	20 0	25 0





MORTON'S
Patent Self-Sealing
RETORT LIDS,

WITH

HOLMAN'S NEW PATENT BRACKETED CROSS-BARS, ANTI-FRICTION CATCHES, AND ECCENTRIC FASTENINGS.

Instantaneous Sealing effected. No Luting. No Duplicate Lids required. Holman's New Self-Sustaining Cross-Bar ensures freedom of joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested (rigid cast iron is now successfully employed), nearly 25,000 being in use at various Gas-Works in London and the Provinces.

IMPORTANT TESTIMONIAL.

The Gaslight and Coke Company (commonly called the Chartered Gas Company), Beckton, North Woolwich.

Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them. I should be very sorry to return to the old system of Luting, and our stokers here freely acknowledge the benefit to them of the new system.

I am, yours truly, (Signed) G. C. Trewby.

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dronfield, Dursley, Exeter, Guernsey, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875

Messrs. Tangye Brothers and Holman.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,

(Signed) John Johnson.

PRICES AND FULL PARTICULARS ON APPLICATION TO

TANGYE BROTHERS & HOLMAN,

SOLE MANUFACTURERS,

LAURENCE POUNTNEY LANE, LONDON, E.C.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

TO GAS ENGINEERS AND MANAGERS.

It having come to our knowledge that a report is in circulation, spread by some unprincipled person or persons, that the cases of our larger-sized Meters are made of Galvanized Iron, we think it only fair to ourselves, and just to our customers, to say, that we never have used, in making any of our Meters, a single pound of *Galvanized Iron*, or any other *cheap* and *inferior material*, and this can be easily seen by opening any of them.

The cases of our large-sized Meters, from 20 lights and upwards, are all made of the very *Best Best Patent Alloy*, which is nearly double the price, and will last more than double the time, of some other material that has been and still is very largely used for the same purpose. And our experience, acquired by an extensive use of it for upwards of 30 years, enables us to say with confidence that no other metal in use for the purpose is so little liable to corrosion from the action of the gas.

We have now in use a Meter made in 1848, and therefore 29 years old, the case of which is made of Patent Alloy; the Meter is still in perfect order, and shows no signs of decay.

The utmost care is exercised by us in selecting none but the very best materials for all parts of our Meters; much of it is made *expressly for us*, as it is not possible to obtain it in the open market of the same superior quality.

The great fall in the price of all materials used in making our Meters has enabled us to give an increased discount, thus giving our customers the benefit of the fall. This we were bound in fairness to do, as we raised the price of our Meters four years ago, when the price of all metals went up.

It will be our constant endeavour, by using none but the best materials, and employing the most skilful workmen, to maintain the high character our Meter has hitherto borne.

WILLIAM PARKINSON & CO.

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF PATENT

WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

CONTENTS.

	Page
Circular to Gas Companies:—	
Abandonment of Negotiations for the Purchase of the Exeter Gas-Works	9
"Popular Delusions"	9
Mr. Sugg on the Lighting of Railway Carriages	9
Mr. Wilson on Automatic Lamp Lighting and Extinguishing	9
Purchase of the Ilkeston Gas-Works	10
Reduction in the Price of Gas at Leeds	10
The Coleraine Commissioners and the Price of Gas	10
The "Sulphur" Question at Maidstone	10
Proposed Purchase of the Stoke and Fenton Gas-Works	10
Forthcoming Meeting of the North British Association of Gas Managers	10
Water and Sanitary Notes:—	
The Metropolitan Board and the Public Health (Metropolis) Bill	10
The Government and the Thames Floods Prevention Bill	11
Waste of Water at Dublin	10
Water and Beer at Wrexham	10
Local Government Board Inspectors	10
Leading Article:—	
Contributions to the Theory of Luminous Flames. By Dr. Karl Heumann	11
Correspondence:—	
The Valuation of Lime and Gas Liquor	12
A Caution	12
Exhausters	12
Parliamentary Intelligence:—	
Progress of Bills in House of Lords	12
Progress of Bills in House of Commons	12
Local Government Board Inspectors	12
Legal Intelligence:—	
Supreme Court of Judicature—Court of Appeal—	
The Mayor and Corporation of Birmingham, *Appellants*, *v.* Allen and Another, *Respondents*	13
Thompson and Another *v.* The Sunderland Gas Company	13
High Court of Justice—Queen's Bench Division—The Metropolitan Board of Works *v.* The New River Company	13
Court of Bankruptcy—*In re* Benjamin Higgs	15
Miscellaneous News:—	
Lighting of Kingston, Jamaica	12
British Association of Gas Managers	15
Meeting of the Malta and Mediterranean Gas Company	21
Meeting of the Chelsea Water-Works Company	22
Abandonment of the Exeter Gas-Works Purchase	23
Working Gas Retorts by Mechanical Means. By Mr. Charles C. Mowton	24
Trade Reports	25
Explosion of Gas in Liverpool	26
The Failure of Messrs. Blews	26
Reductions in the Price of Gas	26
Metropolis Floods Prevention	26
Register of New Patents:—	
Applications for Letters Patent	26
Share List of Metropolitan Gas and Water Companies	27

NOTICE TO SUBSCRIBERS.

An Index and Title-Page to the First Half-Yearly Volume of the JOURNAL for 1877 are furnished with this number, and cloth cases for binding may be obtained on order from any bookseller, or from the Publisher.

Subscribers who desire to avail themselves of the reduction in the subscription to the JOURNAL by paying in advance for the second half of the year 1877, are reminded that this can only be done during the present month.

Subscribers who have not paid their subscriptions for this, or for any previous year, are requested to remit the same forthwith to the Publisher, in order to prevent any interruption in the regular delivery of the JOURNAL.

TO CORRESPONDENTS.

G. H.—*The "Treatise on the Science and Practice of the Manufacture and Distribution of Coal Gas," now publishing in monthly numbers, is the only work which will give you the information you seek.*

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 3, 1877.

Circular to Gas Companies.

THE "Electric Candle" has already rendered an essential service to one Gas Company, and is, we believe, destined to prove a decided advantage to many others. It must be distinctly understood that the "candle" is a "success," and, for that reason, we have to congratulate the Exeter Town Council on arriving at a resolution to discontinue negotiations for the purchase of the Gas Company. The Company, we believe, were willing to sell their undertaking at the price usually accorded to a statutory concern—namely, twenty-five years purchase of maximum dividends. That was for the sake of peace and quietness; but they would much rather keep the undertaking in their own hands, and work it in perpetuity, even in competition with the "Electric Candle," should that notable invention ever reach Exeter.

We certainly owe a debt of gratitude to M. Jablochkoff. He has done more than any one has ever done before to render Gas Companies secure in the positions they occupy. Henceforth, whenever the purchase of a Company is suggested or proposed, the "Electric Candle" will be held up, like a scooped-out turnip with a tallow dip in it, to frighten the would-be purchasers. We are perfectly content that it should be so. For reasons upon which we need not enter, but which all our readers will understand, we prefer that the manufacture and distribution of gas should continue to be effected by private enterprise, rather than be a source of profit to Municipalities. Local Authorities may supply gas if they choose, but as ratepaying gas consumers get enlightened as to the proper principle on which gas should be supplied by an authority, they will refuse to pay more than will serve to defray the necessary charges of the undertaking.

The Town Council of Exeter have a canal on their hands, which, we gather, does not pay, and it was actually urged, in favour of the purchase of the Gas Company that the profits of the undertaking might meet the expenses of the canal, and make Exeter a free port. Was anything more monstrous ever proposed? Exeter to be made a free port at the expense of the gas consumers, who, probably, are not more than two-thirds of the ratepayers!

Yes! Dr. Charles Mackay, who is a distinguished political economist, may add another chapter to his book on "Popular "Delusions," if he will peruse and study the following paragraph, which we extract from the *Hereford Journal*:—

"HAPPY HEREFORD!—We Herefordians must congratulate "ourselves on our latest bereavement. The city rate has "expired. It is dead, past, and gone, and will never come to "life again. To be still more explicit, let us put it in this way—"the citizens of Hereford will never have another city rate to "pay. They have paid the very last copper that will be asked "of them. Henceforth the Water-Works, the Gas-Works, and "the Markets will provide all the necessary funds to meet the "expenditure chargeable on the city rate—an expenditure which, "before now, has had to be met by a rate of three shillings and "sixpence in the pound."

There is something supremely rich in the notion that a rate is extinguished when the amount it produces is obtained in an indirect manner from the pockets of the ratepayers. Pay they must, in "meal or malt," but do not let them be deluded. Gas and water profits mean taxation, and this the ratepayers will presently understand. As in the case of Exeter, just alluded to, probably not more than two-thirds of the ratepayers are gas consumers, and on these latter the burden of replacing the "city "rate" must necessarily fall. The Corporation of Hereford, if we recollect rightly, gave the highest price ever paid for a gas undertaking. It was something more than £900 for every £100 invested in the Company, and, so far as we remember, the results have not been particularly successful to the Corporation. But of that we say nothing. We have little doubt that the paragraph we have quoted above is a feeble joke, but we none the less feel bound to call the attention of the gas consumers of Hereford to the real state of the case, if what is said is true.

We continue, to-day, the publication of the papers read at the recent meeting of the British Association of Gas Managers. The lighting of railway carriages by gas is a matter of much interest to Gas Companies, since its general adoption would lead to a considerable increase of consumption. We believe that what has hitherto stood in the way of its more extensive employment has been the want of a tight holder, or, rather, a holder which would not allow of the inter-diffusion of gas and air. This want Mr. Sugg has supplied, and we now expect to see gas more largely employed on railways. To petroleum lamps in carriages we have a strong objection, and railway authorities, for more reasons than one, would be glad to get rid of the use of oil. If, then, gas be laid on at the stations in the manner pointed out by Mr. Sugg, the absolute economy involved in its employment will at once be appreciated. In the remarks we made, some time ago, on the use of Pintsch's compressed petroleum gas on the St. John's Wood line, we expressed no opinion as to the value of the lights. We simply invited our readers to go and see for themselves. We may say, however, to-day, that, in our judgment, the light is very inferior compared with that given by ordinary gas as employed on the Metropolitan line. Mr. Sugg shows, too, that in reality it is dearer; and all things being taken into account, it is probably more costly than Mr. Sugg makes out. It may be an advantage to be able to store under a c rriage sufficient gas for twenty-four hours consumption; but, after all, the light afforded is the true test of value, and we consider that ordinary gas, even as now used, is a much superior mode of illumination. Gas Companies may be thankful to Mr. Sugg for having given such a careful study to this matter.

The lamplighter of our juvenile days, with his light ladder and flaming torch, with whom we have run many a race, is hopelessly extinct. For the moment he is replaced by a well-dressed man, who perambulates the streets with an important-looking wand, and who only wants a gold-laced hat, and a cloak and collar to match, to cause him to be taken for a City ward beadle. He, too, according to Mr. Wilson, is destined for extinction. In the future, gas will be lighted and extinguished automatically—one hand on a valve at the gas-works having entire control over the matter. It must be admitted that at the present moment complete success in this direction has not been achieved; but as our apparatus of distribution is perfected, automatic lighting will become more and more possible. To-day it is little more than a dream.

Notwithstanding the opposition of the Ilkeston Local Board, the Board of Trade granted the Gas Company a Provisional Order, differing but in small particulars from that proposed by the Company. It was included, with others, in a Confirmation Bill that was introduced into the House of Lords, before which tribunal the Local Board continued their opposition. The result has been that the Gas Company have given way, and the undertaking will be transferred to the Board. The history of the Company is not without interest. They started in 1848 under a deed of settlement, with a paid-up capital of £2000. But this was soon found to be insufficient, and from time to time further sums have been raised, and profits have been applied to extensions, until, at the present moment, the expended capital of the Company is estimated to amount to £14,090. The Company supply a hilly district in Derbyshire, and it is not at all surprising that complaints have, at times, been made of inadequate supply. The public lighting has been, it seems, especially complained of, which is not to be wondered at when we are told that the lamps are 150 feet apart. Now the Local Board will see what they can do; but we shall be much astonished if the consumers are in the least benefited by the change. We perfectly agree with one of the witnesses, who has had large experience under both Companies and Corporations, that Companies do their work quite as well and just as cheaply as Local Authorities. The Local Board of Ilkeston have agreed to pay £25,000 for the undertaking, and, considering that the works are reported to be in excellent order, and to have a considerable surplus power of production, they have made a good bargain. So far as we can remember, this is almost the first instance in which a Provisional Order, under the Act of 1870, has been contested in Parliament, and we are not at all pleased at the result. We are not in the secrets of the Company; but, as the matter stands before us, we see no reason why they should have given way.

The Gas Committee of the Corporation of Leeds, after carefully considering the estimates prepared by their engineer, Mr. Woodall, have decided on recommending a reduction in the price of gas from 3s. 3d. to 2s. 9d., with an uniform discount of two and a half per cent. for prompt payment of accounts, which is, to those consumers who do pay promptly, a reduction of sevenpence per 1000 feet. Mr. Woodall calculates that this will save the gas consumers £50,000 a year.

The Coleraine Commissioners do not, or will not, see their way to make any reduction in the price of gas. They charge 5s. 10d. per 1000 feet, and make a profit—not a large one, it is true, but sufficient, according to one of their number, to allow of reducing the price to 5s. per 1000 feet. The majority, however, consider that the commissioners must have a good balance at their bankers, and that gas profits are wanted to relieve the rates; so consumers will continue to pay extra rates in the shape of an exorbitant charge for gas.

The Sulphur Question has cropped up in the Town Council of Maidstone, in which complaint is made that the sulphur in the gas supplied has lately reached the amount of 30 grains per 100 feet. This cannot be regarded as an excessive amount, and, practically, no great complaint is made of it. But Mr. West was for a long time successful in keeping the quantity down to about half the present amount, and now that—owing, it must be, to some accidental circumstances—the quantity has gone up, the Town Council find fault. It is always dangerous to do well.

The Stoke Town Council are anxious to acquire the undertaking of the Stoke and Fenton Gas Company, but a majority of the Council want to get it cheap. A Special Committee have been negotiating with the Company, who have at last agreed to sell at the usual price—twenty-five years purchase of statutory dividends. The capital of the Company amounts to £34,000, and the price to be paid would therefore be £85,000, which is considered by the Committee fair and reasonable. The Council have, however, sent the report back to the Committee for reconsideration. They will never get the undertaking on better terms; but the Gas Company will be perfectly content to retain it in their own hands.

The Annual Meeting of the North British Association of Gas Managers will be held at Stirling, on Friday, the 13th inst., under the presidency of Mr. Macpherson, of Kirkcaldy. The following papers are promised:—"On a Mechanical Difficulty "with Coal Tar, and Method of Surmounting it," by Mr. John Reid, of the Edinburgh and Leith Gas Company, which suggests to our minds an extended application of Messrs. Pelouze and Audouin's Condenser; "On the Condensation and Treatment "of Gases by the Aitken-Young Process," by Mr. R. Mitchell, of Coatbridge, from which process we expect excellent results; "On the Causes affecting the Quantity of Carbon Deposited "in Retorts," by Mr. Young, of Clippens, which, of course, can only be a question of exhaustion; and "On Internal Gas "Fittings," by Mr. J. Hall, of St. Andrew's—perhaps the most important matter with which a manager can deal. Most of the contentions between Gas Companies and consumers arise within the houses of the latter, and bad fittings are to blame for nearly the whole. The lecture will be delivered by Dr. Wallace, of Glasgow, on the "Bunsen Burner." As will be seen, the papers possess much interest, and we have no doubt the meeting will be very successful.

Water and Sanitary Notes.

At their last meeting the Metropolitan Board of Works collectively decided on offering a mild opposition to the Public Health (Metropolis) Bill. The measure is in no way offensive to the Board; on the contrary, the 68th and 69th sections confer on them additional powers, which we consider it highly desirable they should possess. But then every individual member is a Vestryman or a member of a District Board, and it is to these authorities that the Bill is obnoxious. Therefore, while the Board disapprove of the Bill as a whole, they have no objection to the clauses which give them extended powers. Seeing the dead-lock at which the Government have arrived in the conduct of their parliamentary business, we do not expect to hear much more of the Bill this session. The Government can carry it if they like; but we do not expect they will force the measure on, against even the feeble opposition which the Metropolitan Authorities can, at the most, exercise. We have already pointed out that the provisions against which the London Boards protest are already in force all over the country outside the metropolitan area, and we cannot, for the life of us, see why, if they are desirable in the provinces, London Authorities should be exempted from their operation. Against centralization, however, in any shape, we feel bound to protest. In these days of what Mr. Lowe calls "grandmotherly government," and in which, as he puts it, the inspectors bid fair to outnumber the inspected, nothing can be said too strong against the power of domination asserted by our central Boards. It strikes at the very root of our system of independent local self-government.

Returning to the Metropolitan Board, however, we must remark that they do not enjoy the complete confidence of all their constituencies. The Riparian (Thames) Authorities sent a deputation to the Home Secretary, last Thursday, to induce the Government to take up the Thames Floods Prevention Bill, amended according to the suggestions of the Select Committee of the House of Commons. One of the speakers said hard things of the Board, and, indeed, hinted that they did not command the confidence of the metropolitan ratepayers generally. The Home Secretary promised to bring pressure to bear on the Board, in order to compel them to proceed with the Bill as amended; but no good is likely to come of that. The Government must take up the Bill, or allow it to fall through; and, in the latter case, Lambeth, Wandsworth, and Fulham will again be inundated, with the usual consequences—misery and discomfort, mitigated by public subscriptions.

It is time that the Corporation of Dublin did something to prevent the enormous waste of water which goes on in their city. This is the substance of the last report which has reached us: Quantity of water sent daily into the city during the week ending June 20 last, 7,684,984 gallons; quantity wasted daily during the same period, 5,750,938 gallons. About three-fourths of the water which the Corporation supply at so great an expense actually wasted!

The Medical Officer of Health of Wrexham has had the following notice printed and posted all over the town:—

> Borough of Wrexham.—Having had submitted to me for examination specimens of the water supplied to the town by the Wrexham Water-Works Company, and having tested the same, I am of opinion that such water should not at present be used for drinking. I am informed, however, that the deterioration is accidental and temporary, and that the company are using all means in their power to restore the purity of the water, and that such result will very soon be attained.

The doctor is, of course, not in league with the brewers, but we find the notice quoted as an excuse for excessive drinking, to which, it is alleged, Wrexham folk are addicted. We should, however, have been glad to see the reasons the doctor had for so strongly condemning the use of the water.

We are happy to see that Mr. Sclater-Booth has forbidden the engineering inspectors of the Local Government Board from giving evidence in a private capacity on matters dealt with by the Board. We feel some sympathy with these gentlemen, who are not too highly paid; but they must take their choice between offices in Westminster, and official employment at Whitehall. It cannot be tolerated that gentlemen in Government service, which necessarily gives a *prestige* to their names, should compete with plain C.E.'s.

CONTRIBUTIONS TO THE THEORY OF LUMINOUS FLAMES.

By Dr. KARL HEUMANN.
[Translated from the *Journal für Gasbeleuchtung.*]

PART II.

In a former paper, "On the Space between the Flame and the Burner," it was shown that this phenomenon is occasioned by the refrigerating influence of the neighbouring body (wick or burner). The gas is cooled down below its temperature of inflammation, and the flame is accordingly extinguished in the immediate proximity of the cooling body.

With these observations may be ranged a similar phenomenon observed in the combustion of alcohol or coal gas, if either of these combustibles issue with great force from a tube. The experiment called the "luminous fountain" has long been known, and is produced by heating spirits of wine to boiling point in a hollow tube of metal with the end closed; on the opening of the cock, the boiling spirit is driven up with considerable force towards the ceiling. If a flame is brought near the point of exit, the spirit only burns near the ceiling, the column itself remaining dark; to inflame the latter, the exit-pipe must be surrounded by a rim containing some burning alcohol.

Not having this apparatus, I made a similar experiment, as follows:—A copper flask was filled one-third full of alcohol, and closed by a stopper, from which proceeded a glass tube having an elbow joint, the horizontal arm of which terminated in an opening 3 millimètres wide. After the stopper had been properly fastened in by wire-thread, the spirit was made to boil violently. The vapour streaming out with great force could be lighted, and formed a large roaring flame, the base of which was 10 to 12 centimètres from the end of the tube.

With this experiment I would couple a recent examination by M. Benevides, which showed that the flame of compressed coal gas does not begin at the point of exit, but only at a distance of several centimètres from it. The above-named author proved by experiment that the temperature of this dark space is very low—certainly a self-evident fact, for the gas cannot be hotter here than at any other portion of the conducting-tubes, because the process of combustion only begins where the flame becomes visible—that is, further down the stream. Benevides was induced to consider the existence of this intermediate space as a consequence of the mechanical action of the gas-jet, which forced back the air to a certain distance. This would cause the necessary oxygen to be wanting for a certain space, within which, therefore, combustion could not take place. If the exit-pipe was very narrow, and the velocity of the gas-jet very great, the violent displacement of the air would render combustion impossible, and the flame would be entirely extinguished.

I must confess I am not satisfied with this explanation; at least, it seems to me incomprehensible that the flame should not be able to exist because the oxygen is forced back, and that, therefore, want of oxygen caused the extinction of the flame. This takes place in the *interior* of every flame—not only in that of compressed coal gas—and is well known as the cause why flames are cold in their interior, and form, not solid, but hollow cones of incandescent gas. But this forcing back of the air is clearly only effective through a small space at the *outer* boundary surface, in which the chemical union—the process of combustion—takes place. Consequent upon the inter-diffusion of gas and air, the surface of contact becomes a layer of greater or less thickness, in which both gases are mixed in the necessary proportions, and so can form the flame-envelope.

All these are such well-known facts, that it would have been unnecessary to allude to them if Benevides had not set up his theory apparently without considering them. Increased pressure on the gas only enlarges the cold portion of the flame, and thus pushes the side wall and the head of the flame further away; but the flame-envelope cannot be extinguished at the sides, in consequence of the forcing back of the air, though this takes place in Benevides's experiment. There must, under all circumstances, be a boundary zone of combustible mixed gas and air. Why the combustion in this boundary zone is not propagated backwards is, therefore, the question to be answered, and for which the explanation of Benevides must be set aside as insufficient.

Two factors, of totally different natures, appear to me to be the causes of this considerable space existing between the burner and the flame of a strongly compressed gas—the absorption of heat caused by the rapidly succeeding stream of gas,* and the ratio between the rapidity of the gas stream and the rapidity of propagation of the inflammation. This latter point was alluded to by Benevides incidentally, but not included in his theory.

With respect to the refrigerating effect exercised by the rapidity of the gas stream on the lower portion of the flame, I should consider this as twofold. The layer of flame formed close above the burner is cooled by the gas stream in a similar manner as if a metal rod were inserted, though in a much smaller degree, on account of its inferior conductivity, and is extinguished for a certain distance—that is, the flame-layer in the lower part of the flame-envelope is thinned from within outwards. The force of the issuing gas stream also, as Benevides found, no doubt draws in the surrounding air; when the rapidity of exit is great, the air penetrates in excess into the lower portion of the flame envelope, and abstracts heat from the outside. The action of the forcible in-draught of air and of the cold gas stream, therefore, mutually assist each other, and may, under certain conditions, be the cause of the flame becoming extinguished in the immediate neighbourhood of the burner, and only appearing further down the stream, where the velocity of the constantly expanding gas-jet is sufficiently reduced, so that the refrigeration here is no longer so energetic.

That the gas cannot be lighted if the velocity of issue is very great, or that an existing flame is blown out by its own gas if the pressure is greatly increased, may be explained as follows:—At first, in consequence of the increased abstraction of heat, a continually increasing space is created between the flame and the burner; in this long interval a considerable excess of air is drawn in, till, at length, when the velocity of the gas stream is sufficiently reduced, it is already so diluted with air that it can no longer be kindled.

The explanation thus attempted of the space between the burner and the flame of a gas issuing with great velocity, assumes that this space is diminished, or disappears, when the gas stream is brought to a higher temperature before it is lighted. Direct experiment confirms this assumption, for the flame of a strong jet of vapour of spirits of wine, issuing from a platinum tube, which was some centimètres distant from the point of exit, returned to it when the platinum tube was heated red hot; nor do I doubt that if the experiment of Benevides were repeated with strongly-heated coal gas—say, by passing the gas through some length of red-hot tubing before lighting it—a much smaller space, or even none at all, would be found to exist. But I do not possess apparatus suitable for such experiments.

Although these phenomena may be explained by the refrigerating action of the gas-jet, I am inclined to consider this action after all as very trifling; the fact that the space in the flame of the spirits of wine immediately disappears, if even a very minute flame is brought close to the orifice of the jet, goes to prove that the propagation of the inflammation is a far more important element, for the increased heat of the gas-jet by such a small flame can only be very trifling.

As another cause of the existence of this space between the burner and the flame in highly compressed gas, the ratio between the velocity of the issuing gas and the velocity with which the inflammation is propagated has been indicated. To obtain a clear conception of this factor, let it be supposed that the flame of the issuing gas-jet remains at a distance of several centimètres from the orifice of the pipe. The question arises, why does not the flame travel backwards to the burner? that is, why is not the combustion propagated along the surface of contact of the gas and the air backwards towards the burner?

The continuity of a flame consists in the continual inflammation of the adjacent combustible particles by the heat developed from the previously inflamed particles. This propagation of the inflammation will, of course, take place in all directions, provided inflammable matter exists there, and as the space between the burner and the flame will also contain an inflammable mixture at the surface of contact between the gas and the air, the inflammation *must* be propagated backwards; and yet it appears as if it were not so. I say it *appears* as if it were not so, because we are apt to consider the flame as something independent and stationary, instead of what it really is—a small portion of a rapid gas stream, which is only visible to us for a short distance—namely, while it is incandescent.

Let us notice the construction of the magnesium lamps, in which the wire, by means of rackwork, is moved forward at the same rate as it is consumed. By this means the flame is constantly retained in the same spot, the focus of the concave mirror. If the movement is stopped, the flame will gradually burn backwards on the wire; if the wire is pushed forward too rapidly, the flame is moved further forward. The flame will only remain steadily in one place if the wire is pushed forward exactly as fast as the flame would burn backwards if the wire were immoveable. This backward movement of the flame is necessitated by the propagation of the inflammation; it will be effected more rapidly the higher the temperature of combustion, and the lower the temperature of inflammation is.

The rapidity of the propagation of inflammation is, therefore, in a direct ratio to the difference of these two temperatures, and is in an inverse ratio to the difference between the temperature of inflammation and the original temperature of the body before it is kindled. The rate of propagation of the flame may therefore be increased by previous heating of the combustible; it is instantaneous as soon as the initial temperature is equal to the temperature of inflammation; it is diminished by reducing the temperature of combustion, as by the admixture of neutral gas; and the rate of propagation will be reduced to zero when the temperature of combustion is reduced to that of inflammation.

Besides the above elements, the rapidity with which flame is propagated will depend upon the specific heat and the conductivity of the combustible; it is probable that the area of surface and of a cross-section may also affect it, but these influences could be eliminated in comparative experiments.

In case the refrigeration by the rapidity of the gas stream, and by the surrounding air, is proved immaterial to the formation of the space in question, or if its effects can be eliminated, comparative experiments might perhaps reveal some interesting relations between the rate of propagation of the flame of different combustibles and their temperatures of inflammation and combustion. For solid bodies, such as magnesium, the rate of propagation will exactly equal the speed with which the wire must be propelled forward, in order to keep the flame stationary at one point, or the time might be determined which elapses before the flame reaches the other end of a wire of known lengths, &c., &c. Inflammable liquids might be poured into a trough, and the time noted which elapses before the combustion, originated at one end of the trough, reaches the other end. For liquids that only burn with a wick, strips of linen of a given length may be saturated with the liquid, and the time also noted in which the flame reaches the opposite end of the strip when kept in-

* The refrigeration caused by the edge of the burner can only extend to its immediate neighbourhood, not to such a considerable distance as that named above.

horizontal position, say, if stretched over wires. By means of such experiments, numbers expressing the relative danger from fire with combustible liquids might be determined.

For gases, the velocity of issue for a given distance of the flame from the burner, or the distance for a given velocity, might be determined. In order, however, to obviate the varying velocities, according to the nature of the gas, at a given distance from the burner, it might be desirable to determine the precise velocity at which the flame is just raised from the burner.*

(To be continued.)

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE VALUATION OF LIME AND GAS LIQUOR.

Sir,—As you appear to be inundated with claims of originality for the simple means of ascertaining the amount of ammonia, whether fixed or otherwise, in gas liquor, I may mention that, for the last 35 years, I have had in constant use a similar apparatus for testing gas liquor; I, however, used it for another and equally important purpose—viz., for ascertaining the value of lime; that is, to what extent it was pure lime, and also for ascertaining the amount of caustic lime left in lime after it has been taken out of the purifier.

The action was very simple. Take, say, 50 grains of the lime to be tried, put it into the flask with some water, and, say, 150 grains of muriate of ammonia. Heat the whole to boiling, and collect the ammonia given off into a vessel of cold water. Then, by means of a solution of test acid, the quantity of ammonia is arrived at, and by a simple calculation the quantity of caustic lime.

In these days of lime purification, the value of a lime is very important, as well as a knowledge of the amount of lime left unacted upon in the purifier.

F. I. E.

June 30, 1877.

A CAUTION.

Sir,—Will you allow me to caution your subscribers against an impostor, who seeks assistance by representing himself to be a son of Mr. Rutter, of Brighton. He favoured me with a call a few days since, but his ignorance of the names of his professed relatives revealed the deception. He has, however, been more successful elsewhere; indeed, I find that he obtained money on this pretence four or five years back, so that it is time he was exposed.

June 28, 1877. A Manager of a Midland Gas-Works.

EXHAUSTERS.

Sir,—Referring to Mr. Paterson's paper, read before the Bristol meeting of the British Association of Gas Managers, and published in your issue of Tuesday last, we read with some surprise of the important points which the author of the paper brings forward to show the economy (?) of the jet exhauster.

Inasmuch as a comparison was made by him of the economy of the jet exhauster with that of the mechanical exhauster, we wish to point out the fallacy of the arguments used.

We were always aware that the jet exhauster was very extravagant in its use of fuel, but we did not till now know for certain that it was such a wasteful apparatus as the very careful trials of Mr. Paterson prove it to be. The average quantity of water evaporated by the ejector at Cheltenham, in accordance with the tables given, is about *two gallons* in passing 1000 cubic feet of gas per hour, against a pressure of only *twelve inches*.

We have tested some twenty of our Gwynne and Beale's patent combined engines and exhausters, of sizes from 50,000 to 200,000 cubic feet per hour, and the result of these tests shows that the average quantity of water evaporated to pass 1000 cubic feet of gas per hour against a pressure of *twenty-four inches* is *only half a gallon*. This we are prepared to prove at any time by submitting our machinery to actual test, showing that the consumption is about one-eighth that of the jet exhauster.

The above comparison, however, only relates to the consumption of water to work the exhauster; now we have to take into consideration the cost of condensing the steam, and reducing the temperature of the gas exhausted by the jet apparatus (no small item). The plant itself would represent a large sum in proportion to the cost of the exhauster, besides which the annual cost of the water necessary to reduce the temperature must be added.

The first cost of the jet exhauster itself is used as an argument in its favour; but when the expensive condensing apparatus, which is a necessary adjunct to this exhauster is added, we maintain that the first cost of our patent mechanical exhauster is little, if anything, more. Any difference in first cost between the two systems is, however, counterbalanced by the extra and continuous expenditure in working the jet exhauster. Where, therefore, is the economy claimed for the jet exhauster?

The deposit of naphthaline is another point which is still more fatal to the jet exhauster. Nothing can be clearer than Mr. Paterson's paper on this point; he says that it was "unexpected." We have never yet heard of the steam-jet exhauster being at work without a considerable deposit of naphthaline. Mr. Paterson distinctly says that naphtha salts were never known in the Cheltenham works previous to the trial he refers to of the jet exhauster. What advantage, therefore, has been obtained with the jet exhauster? Economy in working? Compare the results (eight times more fuel)! Economy in first cost? Certainly not; we will undertake to supply a mechanical exhauster that will cost no more than the jet exhauster and apparatus combined.

Your readers should be in possession of these facts, which speak for themselves. It has been claimed for the steam-jet exhauster that its action is steady. We have invented a system of construction of our patent combined exhausters, which secures absolute steadiness in the exhausts, and the improvement may be applied to any of our machines.

Gwynne and Co.

Essex Street Works, Victoria Embankment, London, W.C.,
July 2, 1877.

* These remarks are merely intended to indicate the means by which such experiments may be carried out. Not possessing the necessary apparatus myself, I am forced to leave their execution to others.

Parliamentary Intelligence.

HOUSE OF LORDS.

Monday, June 25, 1877.

A report was read from the Select Committee on the Gas and Water Orders Confirmation (Abingdon, &c.) Bill, that the promotors of the Ilkeston Gas Order do not intend to proceed further with the same during the present session. The Bill was reported with an amendment, and referred to a committee of the whole House.

The Newcastle and Gateshead Water Bill was reported, with amendments.

The Reservoirs Bill was read a second time and committed.

A petition against the Waterford Gas Bill was presented from the Waterford Chamber of Commerce.

Tuesday, June 26.

The Bristol United Gas Bill was reported with amendments.

The Gas and Water Orders Confirmation (Abingdon, &c.) Bill was considered in committee of the whole House, and amendments made.

Thursday, June 28.

The following Bills received the Royal Assent by Commission:—Gas and Water Orders Confirmation (Brotton, &c.); Local Government (Gas) Provisional Orders (Penrith, &c.); Dundee Gas; Newport (Monmouthshire) Gas.

The Local Government Board's Provisional Orders Confirmation (Bishop Auckland, &c.) Bill was committed.

The Newcastle and Gateshead Water Bill was read the third time, with the amendment, and passed.

The Gas and Water Orders Confirmation (Abingdon, &c.) Bill was reported with amendments.

Petitions against the Local Government Board's Provisional Orders Confirmation (Bishop Auckland, &c.) Bill—District of Bishop Auckland Order—were presented from (1) Bishop Auckland Gas Company, Limited, (2) Inhabitants and consumers of gas in South Church.

Friday, June 29.

The Chairman of Committees informed the House that the opposition to the Newcastle-under-Lyme Borough Extension and Improvement Bill was withdrawn.

The Bristol United Gas Bill was read the third time, with the amendments, and passed.

The Gas and Water Orders Confirmation (Abingdon, &c.) Bill was read the third time and passed.

The Bishop Auckland District Gas, the United General Gas Company (Limerick), and the Waterford Gas Bills were referred to a Select Committee, consisting of Viscount Sidmouth (chairman), Earl Morton, Lord Digby, Lord Aveland, and Lord Blachford; to meet on Tuesday, July 3.

HOUSE OF COMMONS.

Tuesday, June 26, 1877.

The Blackburn Borough Gas, Water, and Improvement Bill (Lords) was referred to a Select Committee, consisting of Mr. Bathurst (chairman), Mr. Clifford, Mr. Coates, Mr. Warburton, and Sir J. Duckworth (referee); to meet on Tuesday, July 3.

Friday, June 29.

The East Worcestershire Water Bill (Lords) was reported, with amendments.

LOCAL GOVERNMENT BOARD INSPECTORS.

Mr. Hutchinson asked the President of the Local Government Board whether he was aware that cases have occurred in which engineer inspectors under the said board have given evidence in a private professional capacity before Select Committees on private Bills; and whether he would state to the House any regulations he has made, or intends to make, in order to prevent a continuance of the same.

Mr. Sclater-Booth said: A case has recently been brought under my notice, in which an engineering inspector of the Local Government Board has given evidence in a private professional capacity before a Select Committee on a private Bill, and I have since ascertained that in three or four other instances a similar thing has occurred; but in those cases the consent of the department was previously obtained. In the particular case referred to, the inspector does not appear to have been aware that he had committed any irregularity, but I have taken precautions to prevent such an occurrence in future, and have given specific directions that the engineering inspectors shall not, either with a view of giving evidence or otherwise, advise in their private capacity on any matter within the jurisdiction of the Board, or in relation to which they may be required to act officially.

Saturday, June 30.

The petition of Matthew Brown against the Blackburn Borough Gas, Water, and Extension Bill (Lords) was withdrawn.

Lighting of Kingston, Jamaica.—The *Colonial Standard* of the 11th of May has the following:—"Jamaica has done well. The introduction of one of the most civilizing influences into our city is now *un fait accompli*. No longer will our streets at night be the reproach of strangers. Darkness, by the beneficent agency of light, is now dispelled from our thoroughfares, and the public can now see how and where to direct their steps. Yes! on the night of the 10th of May, 1877, the goodly city of Kingston was lifted, so to say, from her previous nightly gloom of past generations, and by the ennobling aid of science is to-day able to hold up her head erect among her compeers of the world, in her efforts to be no longer laggard in the march of civilization. The hour appointed for lighting the first gas-jet was eight o'clock p.m., but not until thirty minutes after that hour did his Excellency the Lieutenant-Governor arrive, when, having placed himself in position, and after the band of the 1st West India Regiment had played an enlivening air, a long stick, with a fusee at the end, was handed him by Mr. Stiven, the engineer, by the aid of which, the gas being turned on, he quickly lighted the elegant device in front of Lord Metcalf's statue, amidst the hearty and prolonged hurrahs of the assembled multitude. After an address by the Municipal Board, to which his Excellency replied, hearty cheers were successively raised for Her Most Gracious Majesty the Queen, the Lieutenant-Governor, General Mann, and Mr. Stiven. This latter gentleman was then shaken hands with and personally addressed by the Lieutenant-Governor in most congratulatory terms, to which he replied suitably. His Excellency then took his departure."

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

TUESDAY, JUNE 26.

(*Before Lords Justices* JAMES *and* BAGGALLAY *and Justice* BRETT.)

THE MAYOR AND CORPORATION OF BIRMINGHAM, *Appellants*, *v.* ALLEN AND ANOTHER, *Respondents*.

Mr. CHITTY, Q.C., and Mr. PHIPSON BEALE appeared for the appellants; Mr. SOUTHGATE, Q.C., Mr. INCE, Q.C., and Mr. SPEED for the respondents.

This was an appeal from the decision of the Master of the Rolls, dismissing with costs the action of the corporation, brought to restrain the defendants Allen and Holden from so working their mines of coal or other minerals near to the plaintiffs land as to cause a subsidence or alteration of the surface. The point raised was to a certain extent a new one, and it was a matter of the greatest importance to the corporation, because, according to the view taken by their witnesses, there was danger of their very extensive gas-works at Swan Village coming down if the defendants continued to work in the manner compained of. The defendants land was separated from the plaintiffs boundary by a small intervening slip, and the object of the action was to prevent them from working up to the slip, or within 15 yards of the plaintiffs boundary. The evidence showed that there had already been some subsidence of the surface, and that if the workings were continued the result would be serious injury to the gas-works. The Master of the Rolls held that there was not sufficient evidence of surface subsidence to warrant an injunction, and the plaintiffs right to lateral support was confined to the land immediately adjoining their buildings, and did not extend to land beyond.

Justice BRETT remarked that the suit was instituted in fact to restrain a man from working under his own land.

Mr. CHITTY admitted that that was so, but the plaintiffs clearly had a right to be protected from having their buildings let down by the mining operations of their neighbours. The Master of the Rolls held that the defendants were entitled to work as they were doing, because, in his view, if the intermediate space had not been worked, the damage would not have been done.

Lord Justice BAGGALLAY suggested that, as the plaintiffs were the purchasers of mines that had been worked out, if, as the Master of the Rolls thought, no damage would have been done but for those mines having been worked, then the claim for damage might possibly be against themselves.

Mr. CHITTY said the plaintiffs surface right was on the east side of the canal, which, for all practical purposes, was their boundary; and it had been proved that there was a subsidence in the canal banks, and that mischief had been done to the plaintiffs retort-houses. What he contended for was that the defendants had no right by their working of the adjacent land to injure the plaintiffs, and that for that purpose the adjacent land was the nearest unworked land, the working of which would cause the injury.

Mr. SOUTHGATE contended that if the coal had not been worked from under the plaintiffs retort-houses there would have been no subsidence, and that the remedy was against the persons who were actually the cause of damage, not against the defendants, who had done no wrongful act.

Their LORDSHIPS sustained the decision of the Master of the Rolls, and dismissed the appeal, with costs.

(*Before the* LORD CHANCELLOR, *the* LORD CHIEF JUSTICE, *and Lord Justice* BRAMWELL.)

THOMPSON AND ANOTHER *v.* THE SUNDERLAND GAS COMPANY.

Mr. CHARLES RUSSELL, Q.C., and Mr. M'CLYMONT appeared for the plaintiffs; Mr. HERSCHELL, Q.C., and Mr. SHIELD for the defendants.

This case raised important questions as to the construction of the Gas-Works Clauses Act, 1847. The plaintiffs are iron shipbuilders at Southwick, near Sunderland, and the defendants a gas company, incorporated by Act of Parliament, supplying gas to a district which includes Southwick. Through the plaintiffs premises runs a public foot-road and a private cart and carriage way, used only by the plaintiffs and the owners of the adjoining property, and under the road and the way are several arches which belong to the plaintiffs, and are used by them as store-rooms. By the Gas-Works Clauses Act, which is incorporated with the defendants special Act, it is provided that the undertakers may open and break up any sewers, drains, or tunnels within or under streets, and lay down pipes, &c., "doing as little damage as may be in the execution of the powers hereby granted, and making compensation for any damage done in the execution of such powers." But the following section is to this effect:—Provided nothing shall empower companies to lay down or place any pipe or other works "into, through, or against any building, or in any land not dedicated to public use," without the consent of the owners or occupiers. In excavating the road to lay down their pipes, the gas company broke through the brickwork of the arches, so that the space in which the plaintiffs store their goods became filled with rubbish, and useless for that purpose. On this the plaintiffs brought an action against the company, which was tried at the Durham Spring Assizes (see JOURNAL, vol. xxix., p. 378), when the jury found that the road over the arches was a highway, and that the defendants had not constructed their works negligently, and they assessed the damage done to the arches at £25. The learned judge then directed judgment to be entered for the defendants, on which the plaintiffs appealed unsuccessfully to the Exchequer Division, and from there to this Court.

The COURT were of opinion that the arches in question constituted a building within the meaning of the Act. The history of the arches was not very clear; they might have been built to support the road, or the owner of the soil, when the road was made, might have thought they would be convenient to him. They were useful and had been used, and the Court could not see why they were not buildings. That word referred, moreover, to buildings below the soil, as well as those built upon the soil. Many important parts of a house were frequently extended beneath a road, such as the cellars for wine or coals, and it could not be supposed, as the defendants contended, that a gas company were empowered to interfere with these as they pleased. If the arches had been made solely to support the street, it might be a question as to how far they could be considered a building within the meaning of the Act; but here the arches had apparently been used as long as the road itself by the owners of the soil. There was no parliamentary power enabling the defendants to interfere with these arches without the consent of the owner, and judgment, therefore, would be entered against them for £25, the damages assessed by the jury.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

FRIDAY, JUNE 15.

(*Before Justices* MELLOR *and* LUSH.)

THE METROPOLITAN BOARD OF WORKS *v.* THE NEW RIVER COMPANY.

SUPPLY OF WATER FOR WATERING ROADS.

Mr. J. BROWN, Q.C., and Mr. BIRON appeared for the plaintiffs; the SOLICITOR-GENERAL, with Mr. THESIGER and Mr. A. E. HARDY, for the defendants.

In this case the Metropolitan Board of Works had required the New River Company, under the 41st section of their Act, to supply them with water by meter for the purpose of watering the roadway of the Victoria Thames Embankment; and in an action brought against the company to enforce this requirement, Justices Blackburn and Quain upheld the order of a judge at chambers, to the effect that, as no questions of fact were in issue, the questions at law should be raised in a special case, as to whether there was an obligation on the part of the company to supply the board in the way demanded. The special case now came on for argument.

Mr. BROWN, after reading the special case, said: I will now direct the attention of your lordships to the Act of 1852, which is the New River Company's Act. Our contention under this is that they are bound to supply us under the 41st section, under which section we shall have the water, considering the large quantity we take, at the rate of 6d. per 1000 gallons, whereas if we are to be supplied under the section they stand upon, the section contained in the General Water-Works Clauses Act, and not in their special Act, the charge will be about double. I shall have to direct your lordships attention to one or two sections which are not set out in the case. If your lordships will look at the Act of 1852, the New River Company's Act of 1852, 15 & 16 Vict., cap. 160, the first section you will find which regulates the supply of water for domestic purposes is the 35th. That, as your lordships will see, applies to houses and parts of houses in streets, and it entitles the owner or occupier of any house, or part of a house, to demand a supply for domestic purposes, and the company are to supply it "at the rates hereinafter specified;" and then we find that those rates are estimated by the annual value of the houses.

Justice MELLOR: They take what they consider to be a fair average of water supply to a house of a certain rent?

Mr. BROWN: Yes, it is regulated in this section; there is 4 per cent. per annum on the rent where it does not exceed £200, and where it exceeds that it is 3 per cent. per annum. Then there are certain additional rates for water-closets, baths, and so on, which appear also to be regulated by the rental. Of course, the supply we want here is not for domestic purposes. We want it for watering the road on the Embankment. It is to be observed that section 38 contains not exactly a definition of what is a domestic purpose, but a declaration that water wanted for certain things is not wanted for domestic purposes within that section. Section 38 says: "A supply of water for domestic purposes shall not include a supply of water for steam-engines, or railway purposes, or for warming or ventilating purposes, or for working any machine or apparatus, or for baths, horses, cattle, or for washing carriages, or for gardens, fountains, or ornamental purposes, or for flushing sewers, or drains, or for any trade or manufacture, or business requiring an extra supply of water." Now, of course, we do not say that this is for domestic purposes. Then we come to section 41, which is what we stand upon, and that section enacts that "The company shall"—so that, of course, it is imperative—"at the request of any consumer of water"——

Justice LUSH: Are you consumers of water within the meaning of that?

Mr. BROWN: Yes, my lord; we are large consumers of water.

Justice LUSH: *Primâ facie* it seems to provide for the cases which are excluded from the rating.

Mr. BROWN: Not only for those, but, as we submit, for others. Section 38 does not profess to give a definition of what are domestic purposes, but it says that certain things shall not be considered as domestic purposes.

Justice LUSH: Your Act incorporates the General Water-Works Act of the 10th Victoria.

Mr. BROWN: The New River Company's Act incorporates the Water-Works Clauses Act, except certain provisions with respect to communication-pipes, and another section about a constant supply of water for domestic purposes to be kept at high pressure.

Justice LUSH: Then the 37th section of the 10th Victoria must be read as if it were a section of the New River Company's Act.

Mr. BROWN: Your lordship will find it subject to this exception. In the first section of the Act of 1847, the General Water-Works Clauses Act, it says, "All the clauses of this Act, save so far as they shall be expressly varied or excepted by any such Act"—that is a Water-Works Act—"shall apply to the undertaking authorized thereby."

Justice LUSH: Yes; but if the clauses can be read together without being inconsistent, you must read them as if they were both in this Act.

Mr. BROWN: I am not going to forget section 37. I was coming to it. Section 41 says that "The company shall, at the request of any consumer of water." It does not say the occupier of any house, still less does it say for domestic purposes, or anything of the sort, but it says, "at the request of any consumer of water" they are to afford a supply at such and such rates. Now, a person taking water for flushing sewers or drains would be a consumer of water necessarily implied in the previous section 33. "Consumer," of course, includes "consumers" in the plural as well as in the singular; but there is no definition of what a consumer of water is. A consumer of water is a person who requires water to be supplied to him "for purposes other than the purposes for or in respect of which the rates or charges are hereinbefore provided or limited;" and the company are to "afford a supply of water by means of a meter, or other instrument or mode for measuring and ascertaining the quantity of water so supplied; and may charge for such supply not exceeding the following rates per 1000 gallons." The whole of the rates are rates by quantity, you will observe. If it does not exceed 50,000 gallons in a quarter of a year, you are to pay 7½d. per 1000, and so it goes on till it comes to 6d. "When exceeding 200,000 gallons, 6d." It is to be observed that the phrase used here is this: "When the quarterly consumption of water shall not exceed 50,000 gallons, 7½d." My friends say that does not apply to us for this reason—that we do not use the water all the year round, and, consequently, the case does not fall within that section. I apprehend that it is a complete fallacy, because your lordships will find what the reason is why the term "quarterly consumption of water" is used, by adverting to two clauses in the Water-Works Clauses Act. By that Act all these rates and sums are made payable quarterly. You will find that at section 70 and section 74 of the Water-Works Clauses Act. Section 70 of the Water-Works Clauses Act is this: "The rates shall be paid in advance by equal quarterly payments—in England or Ireland, at Christmas-day, Lady-day, Midsummer-day, and Michaelmas-day, and in Scotland at Martinmas, Candlemas, Whitsuntide, and Lammas—and the first payment shall be made at the time when the pipe by which the water is supplied is made to communicate with the pipes of the undertakers, or at the time when the agreement to take water from the undertakers is made." Then section 74 says, "If any person supplied with water by the undertakers, or liable as herein or in the Special Act provided to pay the water-rate, neglect to pay such water-rate at any of the said times of payment thereof, the undertakers may stop the water from flowing into the premises in respect of which such rate is payable, by cutting off the pipe to such premises," and so on. Therefore the meaning, as I submit, of section 41, when it uses the terms "When the quarterly consumption of water shall not exceed 50,000 gallons," is simply this: When you do not take more than 50,000 gallons, it is 7½d., but when you take 200,000 gallons it is 6d. My learned friends want to read this not to make the rates according to the quarterly consumption; but according to the yearly consumption, because their contention is that we do

not take the water all the year round, but from Lady-day to Michaelmas—that is to say, during the dry part of the year, and we do not take it every day during that period, because, in the other part of the case, it appears that, out of the 365 days of the year, we take it about 120 days; for suppose a week of rainy weather comes, nobody wants more water on the Embankment than is supplied by the rain, because there is more than is agreeable already. But then we take the water during two quarters of the year, exactly as anybody else might do who wanted it for his garden or his baths. We take it, therefore, during two quarters of the year, and during those quarters the quantity might be easily ascertained. Your lordships will observe, if my learned friends contention is correct—that is to say, unless you take the water the whole year round, this term "quarterly" does not apply to it, this consequence must necessarily follow, that you would not be able at the end of a quarter to ascertain what a man was to pay; you would be obliged to wait not merely to the second, but to the third and fourth quarters. My friends contention would be attended with many singular consequences. In the case of a man who had had the water for one quarter, and then left his premises, and did not want more, it would be difficult to say at what rate he was to pay. All such difficulties are avoided by saying that "quarterly" means just what it says. It is not "yearly" or "half-yearly," but when the quarterly consumption does not exceed 50,000 gallons. If a man takes 50,000 gallons this quarter, and 100,000 gallons the next, and 150,000 gallons the next quarter, it does not mean that they are all to be averaged together, but it means that what you take in a quarter you shall pay according to that quantity, so in the second, and if in the third you take nothing, you pay nothing, and so in the fourth. That, I submit, is the simple, natural meaning of these terms, and if there be any ambiguity your lordships know the well-known rule of construction to be applied. It is an agreement made between the company and the public; therefore, if there is any ambiguity about it, it should be construed in a sense which is favourable to the public. However, I do not myself admit that there is any ambiguity in it at all. I submit it means what it says—that what you take in any quarter you are to pay for. It certainly does not mean that you are to pay according to the quantity you take in half, or three-quarters, or the whole year. That is what my friends contend for, because they say this clause does not apply to us, because we do not take the water all the year round. The same argument will, of course, apply. My friends contention will apply to several purposes for which water will be required, under section 38, which are declared to be not for domestic purposes; for example, a supply of water for warming purposes, under section 38, is not in the domestic class. Then there is the supply to baths, also under the same section. That, probably, would only be wanted in the summer season. Then there is the supply to fountains, and the supply for ornamental purposes; the supply for flushing the sewers and drains would in all probability be wanted about the same time we want water for washing the streets. Therefore, my friends contention would cut off, from the benefit of section 41, a large number of people who want water for the purposes mentioned in section 38, which are not domestic purposes. I cannot see how my friends contention has any reason in it, because in all cases under this 41st section you pay according to the quantity of water consumed. The less we consume per quarter the higher is the rate we pay, and the more we consume the lower is the rate. My friends next argument, as stated in paragraph 19, is—"That the 41st section only applies to cases of regular quarterly consumption, and not to the case of street-watering, the requirements for which purpose are not only not regular, but for which purpose during two-thirds of the year no supply whatever is taken. But the standard of charges fixed by such section does not apply to any case where the irregularity of demand is such that for two-thirds of the year there is no quarterly supply whatever. That the quarterly supply means continuous supply quarter by quarter throughout the year. That the 41st section only applies to matters excepted in the 38th section, and does not apply to the watering of streets." I have a difficulty in understanding that—why it should not equally apply to both, because the language of the section is this, and to this language I would ask your lordships to give a construction favourable to the public:—"The company shall, at the request of any consumer of water, for purposes other than the purposes for or in respect of which the rates or charges are hereinbefore provided or limited, or at their own instance, afford a supply of water by means of a meter, or other instrument or mode for measuring and ascertaining the quantity of water so supplied, and may charge for such supply not exceeding the following rates." The only purposes to which a rate or charge is limited are the domestic purposes. I have not been able to fix upon any other purposes. This, therefore, appears to apply to any consumer who wants water for purposes other than the domestic purposes. Then it is quite true that section 38 says that certain purposes shall not be included in a supply for domestic purposes; therefore it is clear that section 41 must apply to them.

Justice LUSH: Both sections speak of baths. The 38th section applies to baths, and so does the 41st. But is not the key to the whole thing that the one class are private baths and the other are public baths?

Mr. BROWN: The 35th section relates to fixed baths in houses.

Justice LUSH: The 37th section, under which the company claim to charge, does speak of baths.

Mr. BROWN: Before I part from the 38th section of the Act of 1852, let me call your lordships attention to this—this seems entirely to negative my friends contention that the General Water-Works Clauses Act makes a provision only applicable to the public purposes, and that the 38th section of the Act of 1852 only applies to private purposes, because you will find by section 38 of the Act of 1852 one of the purposes is for the flushing of sewers or drains.

Justice LUSH: House drains?

Mr. BROWN: It does not say that. It says, "for gardens, fountains, or ornamental purposes, or for flushing sewers or drains, or for any trade, or manufacture, or business requiring an extra supply of water." Now I come to the General Water-Works Clauses Act of 1847. The first observation I have to make about it is that it is not a special Act for the consumers, but it is a general Act for consolidating certain provisions usually contained in such Acts, and its provisions are therefore only intended to apply when they are not superseded by the provisions of any special Act of Parliament. The Act, indeed, says so. The preamble of it recites: "Whereas it is expedient to comprise in one Act sundry provisions usually contained in Acts of Parliament authorizing the construction of water-works for supplying towns with water, and that as well for avoiding the necessity of repeating such provisions in each of the several Acts relating to such undertakings as for ensuring greater uniformity in the provisions themselves." And then it enacts that "This Act shall extend only to such water-works as shall be authorized by any Act of Parliament hereafter to be passed, which shall declare that this Act shall be incorporated therewith, and all the clauses of this Act, save so far as they shall be expressly varied or excepted by any such Act, shall apply to the undertaking authorized thereby," and so on. Then we come to section 37. Your lordships will find, on considering section 37, that it has no application whatever to this case, even as it originally stood, without regarding the effects of the New River Company's Act upon it. Section 37 says this: "In all the pipes to which any fire-plugs shall be fixed, the undertakers shall provide and keep constantly laid on, unless prevented by frost, unusual drought, or other unavoidable accident, or during necessary repairs, a sufficient supply of water for the following purposes;" so that your lordships will observe that this is limited to pipes to which fire-plugs are fixed. Then in section 38 you will find it is enacted that "The undertakers, at the request of the Town Commissioners, shall fix proper fire-plugs in the main and other pipes belonging to them at such convenient distances, not being more than the prescribed distance, or if no distance be prescribed, not more than 100 yards from each other, and at such places as may be most proper and convenient for the supply of water for extinguishing any fire which may break out within the limits of the special Act; and in case of any difference of opinion as to the proper position or number of such fire-plugs, it shall be settled by such inspector as aforesaid," and so forth. And in going back to section 37, you will find that in all the pipes there shall be a sufficient supply of water. I am told that these have no fire-plugs in them, but the reason is that there are no houses there; consequently, no fire-plugs are wanted. There is nothing in this case to show that there are any fire-plugs whatever in the pipes that run along the Embankment.

Justice LUSH: You are claiming from the company the obligation of supplying water. Has any inspector been appointed?

Mr. BROWN: I believe not. It may be that the obligation under the General Water-Works Clauses Act to supply water for washing the streets only arises where there are fire-plugs. That is probably so. In that case the Act says they "shall provide and keep constantly laid on a sufficient supply of water." Looking through this Act, I do not find that any fixed rates for water are provided either for domestic purposes or any other purposes.

Justice LUSH: They leave that to the private Act.

Mr. BROWN: Yes. It may be there is no obligation to supply this water out of those pipes. What we say is this, that that obligation is furnished by section 41 of this special Act.

Justice MELLOR: You say you do not come under the 37th section at all?

Mr. BROWN: We say so, and we further contend that if section 37 would have applied by reason of there being fire-plugs in this pipe, it was superseded by their special Act, which makes special regulations for the Metropolis, because in the Metropolis a pretty constant supply of water is wanted everywhere, both in London and Westminster.

Justice LUSH: I do not find anything in the New River Company's Act proper which touches public purposes at all.

Mr. BROWN: The reason, I submit, for that is that the public purposes and the private purposes are all embraced in section 41, and it is utterly impossible, if your lordships consider this matter a moment——

Justice LUSH: Nor is there any obligation in the private Act to keep up the constant supply anywhere.

Mr. BROWN: Just so.

Justice LUSH: That is why the private Act is incorporated.

Mr. BROWN: It is impossible to suppose (so it occurs to my mind) that this Act of Parliament here makes provision for supplying a very large quantity of water exceeding 200,000 gallons per quarter; that it fixes the limit of the rate to be charged for the supply for private purposes; and puts no limit whatever on the rate to be charged for water to be supplied for public purposes. When you consider that this is framed upon the principle that the larger the supply of water wanted, the lower the rate of payment per 1000 gallons is to be——

Justice LUSH: There are three purposes mentioned—viz., for cleansing the sewers and drains, for cleansing and watering the streets, and for supplying public baths and wash-houses. Those are the three purposes mentioned, those are not the only public purposes, because there are other purposes mentioned—one is the flushing of sewers and drains; another is for gardens, fountains, and ornamental purposes. Do you say the sewers and drains in the 38th section mean the same thing as in section 41? Public sewers and drains are provided for by the public Act.

Mr. BROWN: Will your lordships bear in mind that for years before this it was a general Act.

Justice LUSH: According to you, they had two rates to charge for cleansing the sewers and drains—one provided by the 37th section of the public Act, and one by the 41st section of the private Act?

Mr. BROWN: I am contending that section 41 supersedes the clause in the general Act for flushing the sewers and drains for public purposes—certainly I go that length. I submit to your lordships that section 41 was intended to sweep up all other purposes whatsoever, not being domestic purposes—that these are the plain words of the Act: "The company shall, at the request of any consumer of water for purposes other than the purposes for or in respect of which the rates or charges are hereinbefore provided or limited, or at their own instance, afford a supply of water by means of a meter or other instrument or mode for measuring and ascertaining the quantity of water so supplied, and may charge for such supply not exceeding the following rates per 1000 gallons;" and then it says: "When the quarterly consumption of water shall not exceed 50,000 gallons, 7½d.," according to the quantity taken; so that just see what consequence would follow. If my learned friends construction is the right construction to put upon those words, it comes to this: My friend says it is quite true that for private purposes the New River Company's Act has limited the rate to a sum diminishing as the quantity of water increases, but when you take it for public purposes, which will be in the largest quantities of all—such quantities as the Board of Works or the vestry may take—there the rate shall be unlimited.

Justice MELLOR: Any consumer might make a contract to water the streets, and come in under the name of a consumer, and make this demand under the New River Company's Act, according to your argument.

Mr. BROWN: I should submit that it is not a likely case; no gentleman is likely to go to the trouble and expense of watering the streets for the benefit of the public. In this Act, by the interpretation clause——

Justice MELLOR: Which Act do you mean?

Mr. BROWN: The general Act. It says here, "Words importing the singular number shall include the plural number, and words importing the plural number only shall include also the singular number;" and then it says, "The word person shall include a corporation," and so on. I apprehend, therefore, the word "consumer" would clearly apply to a corporation as well as to a private individual. I submit that the purposes in clause 41 are of a most general description, and sweep up all the cases for which a rate is not provided for before. I submit the scheme of the New River Company Act is this, that the Legislature are providing you with certain facilities for supplying the greatest city in the world, and they say, we shall put you under reasonable terms for the supply of your water for the cities of London and Westminster. We will put you under these terms; you shall supply water at certain rates depending upon the rentals of the houses, and for all purposes, other than the purposes for which the rates have been before provided, you shall supply at such and such a rate per quarter, measured by meter.

Justice LUSH: When your supply is short, and for purposes where there is great waste?

Mr. BROWN: The more waste the better for the company.

The SOLICITOR-GENERAL: It depends upon the rate.

Mr. BROWN: The company never would be contented with these rates unless they were entirely satisfied that they were thoroughly profitable. They have had a great deal of experience in ascertaining the quantity of water required in their district to supply all that is wanted, and a great deal more too; as far as I have read about these matters, I do not think there ever was a case where the supply fell short. I do not know whether section 40, in the New River Company's Act, throws any light upon this. It is permissive merely to the company, viz.:—"The company may supply any person or body within their limits with water, to be used within such limits for other than domestic purposes," and the person or body requiring such supply have to come to some agreement with the New River Company as to the terms and conditions of the supply.

Justice LUSH: That, I suppose, means they are not bound to supply at the rate specified in section 41, if they choose to agree.

Mr. BROWN: I suppose that is the meaning of it. Well, then, section 41 is a compulsory clause that they "shall;" then I submit to your lordships that it is very difficult to suppose that, seeing the limited character of the Water-Works Clauses Act, which only applied to pipes which had fire-plugs attached to them—it is very difficult to suppose that in the case of the New River Company the Legislature would leave this company free from the duty of supplying any public body who wanted water for the purpose of watering the streets, or for flushing the sewers or drains, or for gardens, fountains, or ornamental purposes, and so on, that the Legislature would leave the New River Company free to supply or not at their own pleasure or on their own terms. The fact really is, the more water they supply the more it is to their advantage.

Justice LUSH: They are bound to put in fire-plugs at proper places.

Mr. BROWN: That is only on request, it appears.

The SOLICITOR-GENERAL: A public authority, whoever they are, may make us do so.

Mr. BROWN: It seems very doubtful whether clause 37 would apply to the Board of Works, for I observe the language is, "And such supply shall be provided at such rates, in such quantities, and upon such terms and conditions as may be agreed upon by the Town Commissioners and the undertakers." The undertakers are, of course, the company, but I find in section 3—"The Town Commissioners shall mean the parties defined under that title in the special Act." I do not think we are defined by that title anywhere.

The SOLICITOR-GENERAL: Yes; "Or any other parties."

Mr. BROWN: At the time the Act passed a great many places were under the control of commissioners.

Justice LUSH: At all events it means the bodies who have the control.

Mr. BROWN: It says: "It shall mean the commissioners, trustees, or other parties having the control or management of the streets, under any Act for paving or improving the town or district to be supplied with water under the special Act." I do not see how our Acts can be called Acts for controlling a district.

Justice LUSH: If you are not the commissioners you have no business with this water at all.

Mr. BROWN: We have no business under the General Water-Works Act, therefore I submit that section 37 does not apply to our own case at all—first, because this is not a case where there are fire-plugs; and, secondly, we are not Town Commissioners under the Paving and Improvement Act; and, thirdly, I submit to your lordships, even if that originally applied, it has ceased to apply, because of section 41 of the special Act, which imposes the obligations for supplying water for these purposes irrespective of fire-plugs, and irrespective of Town Commissioners, and to supply it at a rate per quantity in which the whole principle of the section is, that the larger the quantity you supply the smaller is the rate per 1000 gallons that you are to be paying; and it is impossible to suppose that the Legislature would have left this New River Company, making the large profits they do, free from any obligation to furnish a supply at a rate per quantity, when they imposed that rate upon them with respect to all other purposes. More especially when you find, in section 38, any other purposes which are not domestic purposes; one is water for flushing sewers or drains, and another is for gardens, fountains, or ornamental purposes, which would directly apply to the fountains of the Board of Works. Those are the main considerations that have a bearing upon the case, and I must ask your lordships, if there is any doubt about it, to give us the benefit of the doubt according to the principle of interpreting an Act of Parliament in favour of the public.

The Court, without calling on counsel for the New River Company, proceeded to deliver judgment.

Justice MELLOR said: I do not think there is any doubt in this case of which we can give Mr. Brown the benefit. We are both of us quite satisfied that the object and effect of the New River Company's Act is to provide for what is called domestic consumption and domestic purposes—house purposes as distinct from those public purposes, such as watering streets, and so on, which seem to be provided for by the statute of 10 Vict., cap. 17, which is incorporated in this Act of Parliament, excepting only a section which, for special purposes, is excepted from the incorporation of the general Act; but I cannot help thinking, when you look at the section, you will find that the occupier of a house has to pay according to the rateable or annual value, and there is to be a certain rate for the supply of water for that particular house. They have chosen to take a general average, instead of so much per 1000 gallons. Then they say in the 38th section that "A supply of water for domestic purposes shall not include a supply of water for steam-engines or railway purposes, or for warming or ventilating purposes, or for working any machine or apparatus, or for baths, horses, cattle, or for washing carriages, or for gardens, fountains, or ornamental purposes, or for flushing sewers or drains, or for any trade or manufacture or business requiring an extra supply of water." But when you come to sec. 41, where it is provided that the company shall, at the request of any consumer of water for purposes other than those specified as excepted in the 38th section, afford a supply by means of a meter, and so on, then they are requiring the supply to be measured by a very large quantity, "when the quarterly consumption of water shall not exceed 50,000 gallons, 7½d.," according as the quarter's consumption of water is called for by any consumer within the 31st section, and it appears to me this is intended for private purposes as distinguished from public purposes. The watering of streets, under which this claim has arisen, is provided for by the 37th section of 10 Vict., cap. 17. It appears to me that was the object and true intent of the Act, and that the Board of Works must bring themselves and make their contract within the terms of the 37th section of the general Act.

Justice LUSH: I think this is a very plain case. The 3rd section of the New River Company's Act says that "The Water-Works Clauses Act, 1847, except the provisions with respect to the communication-pipes to be laid by the undertakers, and except the section No. 35 in the said Act, shall be incorporated with this Act, provided that the clauses with respect to the construction of the water-works, with respect to the construction of works for the accommodation of lands adjoining the water-works, and with respect to 'mines,' shall not apply to any works constructed or lands acquired by the company previously to the passing of this Act." Then reading the Water-Works Clauses Act, the first section says that "This Act shall extend only to such water-works as shall be authorized by any Act of Parliament hereafter to be passed, which shall declare that this Act shall be incorporated therewith, and all the clauses of this Act, save so far as they shall be expressly varied or excepted by any such Act, shall apply to the undertaking authorized hereby, so far as the same shall be applicable to such undertaking, and shall, with the clauses of every other Act which shall be incorporated therewith, form part of such Act, and be construed therewith as forming one Act." Now, there is nothing in the New River Company's Act which expressly varies or expressly excepts the 37th section; therefore that section is incorporated into the Act, and is to be read in connexion with that Act as if it were a section forming part of the original New River Company's Act proper. Then it is to stand side by side with the 38th and 41st sections of that Act, and all those sections are to be read so as to be consistent with each other, which they may be without doing the least violence to the words. It is obvious, when one looks to the words of the Act, that that Act only meant to apply to the supply of water for private purposes—to individuals for domestic and other private purposes. The 38th section enacts what is not to be considered as within the water-rate, but that the supply of water for domestic purposes shall not include "a supply of water for steam-engines or railway purposes, or for warming or ventilating purposes, or for working any machine or apparatus, or for baths, horses, cattle, or for washing carriages, or for gardens, fountains, or ornamental purposes, or for flushing drains or sewers, or for any trade or manufacture or business requiring an extra supply of water." The 41st section was put in with a view of those excepted cases, and regulates the charges to be made for the supply of water for those, and if there be any other private purposes for all those private purposes. We must now read the section of the public Act which relates to supplying water for public purposes. The 37th section says: "In all the pipes to which any fire-plug shall be fixed, the undertakers shall provide and keep constantly laid on, unless prevented by frost, unusual drought, or other unavoidable accident, or during necessary repairs, a sufficient supply of water for the following purposes—that is to say, for cleansing the sewers and drains, for cleansing and watering the streets, and for supplying any public pumps, baths, or wash-houses that may be established for the free use of the inhabitants, or paid out of the poor-rates," and so on. Now, as Mr. Brown observes, sewers and drains are mentioned in the 38th section, and he contended that they must mean public sewers and drains. Reading the two together, you see the distinction at once; they refer only to sewers and drains belonging to an individual which he wishes to have flushed; the other applies to the public sewers; and so with regard to baths—the one applies to private baths, and the other to public baths established by public authority. It seems to me clear that whenever the water is wanted for a public purpose, such as the present, it is to be supplied under the 37th section of the general Act. Mr. Brown thought a difficulty might arise, because the company are only bound to supply if there is a fire-plug; the consequence is, if they are not bound to supply a fire-plug here, they are not bound to supply water at all. They may if they please, but if they do it then they charge for it according to the rate provided for by the 37th section. It seems, therefore, to my mind, that this is a perfectly clear case, and that the contention of Mr. Brown is utterly unfounded.

The SOLICITOR-GENERAL: There will be judgment for the defendants, and the costs are provided for in the case?

Justice MELLOR: Yes.

Judgment for the New River Company accordingly.

COURT OF BANKRUPTCY.—MONDAY, JUNE 25.

(*Before Registrar* MURRAY.)

In re BENJAMIN HIGGS.

This was an adjourned sitting for the purpose of auditing the accounts and declaring a final dividend in the estate of the bankrupt, who was formerly in the office of the late Great Central Gas Company, and absconded with a large sum of money belonging to his employers.

The adjudication took place in May, 1869, and, on behalf of Dr. Wells, a creditor for £1000, it was now alleged that whereas £8096 had been realized from the property, £1317 only had been distributed, and about £1100 further remained in hand. No doubt the bankrupt, when he absconded, left his affairs in a state of considerable confusion, but it was suggested that the costs had been enormous, and that the expenses of several private sittings had been unnecessarily incurred. At the same time Dr. Wells was not disposed either to incur the responsibility consequent upon a re-taxation, or to delay the dividend.

Registrar MURRAY expressed his astonishment that costs to the amount referred to had been incurred, but said it must be remembered that this was a fraudulent bankruptcy, and the winding-up had involved considerable trouble and litigation.

Mr. ELEY referred to the circumstances which led to the private sittings being held, and said that by the course which the assignees had adopted the proofs against the estate were reduced by about £70,000.

The accounts having been audited, a dividend was resolved upon, an allowance of five guineas being made to Mr. Harston, the solicitor for Dr. Wells.

Miscellaneous News.

BRITISH ASSOCIATION OF GAS MANAGERS.

(*Continued from page* 1028, *vol.* xxix.)

TUESDAY, JUNE 12.

Mr. PEARSON, on behalf of Mr. W. Sugg, who was unable to be present, read a paper on

LIGHTING RAILWAY TRAINS WITH COAL GAS AT LOW PRESSURES.

It seems evident that in a short time the system of lighting railway carriages with oil will be superseded, and some other and better mode of lighting substituted for the present uncomfortable, inefficient, and expensive method.

Already petroleum has been tried in various ways, and at this moment it is really being used in the liquid state on some of the railways. There is certainly an improvement in light given, and probably there is a saving as to cost. But petroleum has never been so prepared that it can be used without danger. It is at once admitted that there have been gas explosions, and damage has been done to life and property during the last 40 or 50 years; that gas has been gradually brought into use, and the public have been trained in the use of it. But the awful nature of the petroleum explosions, and their lamentable frequency during the few years that it has been employed for artificial lighting, have clearly demonstrated that it cannot in any way approach the high degree of safety which has now been attained in the use of coal gas. As to cleanliness and freedom from odour in burning, gas leaves it very far behind. It has been always a matter of wonder to the writer that the public, and more especially the educated public, have gone on using petroleum lamps when they might

have found a safer, better, and a more cleanly and economical illuminating agent in gas.

But then gas has a minute quantity of sulphur in it, and this amount, and the damage it does, has been most pathetically dilated on in Parliament during the last few weeks. The ghost of the never-to-be-forgotten old boot has again been resuscitated; it is true, however, this time, with considerably diminished effect. Backs of books and pictures have, as usual, been terribly ill-used, and the whole paraphernalia and scenic effects of the old farce have been again furbished up and trotted out before a committee, who, after careful examination, have signified their opinion pretty plainly that there is nothing whatever in it.

No one has ever been able clearly to show either discomfort or injury from the products of burnt gas. But, surely, no one who has experienced the nauseous sickening odour exhaled from petroleum lamps, such as are used in tramway carriages, the dwellings of the poor, ay, and even in some of those used in houses inhabited by the wealthier classes, can for a moment contend that petroleum is so healthy and inodorous as gas. Of course, where the most expensive lamps and highly-refined petroleum, almost free from sulphur, are used, then the lighting by petroleum is more successful; but, in quantity of light, cheapness, and handiness, it follows far in the rear of coal gas.

It may be fairly stated that, if a badly-ventilated room were lighted to the same extent with best petroleum oil, as it usually is with gas, the atmosphere of that room would be rendered much more heated, vitiated, and a greater quantity of carbonic acid would be produced.

The heat from a light, equal to 12 candles, produced by petroleum is, in round numbers, one-third more than that produced from the same light given by 14-candle gas, and it will vitiate 112 cubic feet of air, whilst the latter will only vitiate 80 cubic feet. Such oils, however, as these, cannot, by reason of their high price, be used for railway and tramway carriages; therefore it is that there must be both danger and discomfort in making use of such inferior oils as will at all approach gas in point of economy.

In fact, it is within the personal knowledge of the writer, that a petroleum lamp exploded in a first-class railway carriage, seriously burning the cushions, clearly showing what a frightful accident would have ensued if there had been any passengers in it; providentially there were none.

But, even with low-priced oils, there is the cost of trimming and cleaning, and the important item of waste to be added to the prime cost of the oil.

While, however, it is an easy matter to get at the cost of the supply of gas, it is very difficult to get at the cost of petroleum, principally because of the different illuminating powers of different qualities, and the labour in trimming. But, light for light, petroleum and gas stand about in the following relation.

The quantity of gas burned per hour in the Metropolitan Railway carriages is 4 cubic feet to each burner. The gas varies from 16 to 18 candle gas; 4 feet burned in a flat-flame burner can easily be made to give a light equal to 10 sperm candles—burned in a good Argand, it gives a light equal to 13·6 candles. The relative cost of petroleum to produce this result is shown in the Table No. 1.

TABLE No. 1.

Relative Cost of Petroleum and 16-Candle Gas to produce a Light of 10 Sperm Candles, burning 120 Grains per Hour.

One pint of oil lasts seven hours, and costs 2·25d.	28 cubic feet of gas, at 3s. 9d. per 1000 cubic feet, costs 1·1d.

Oil double the cost of gas.

In this comparison it must be noticed that the petroleum lamp has a chimney, and that the light it is capable of giving is developed to the utmost. The gas, on the other hand, has no chimney, and is burned to a disadvantage; but if the gas is burned, like the lamp, to the best advantage, the result is very different. (See Table 2.)

TABLE No. 2.

Relative Cost of Petroleum and 16-Candle Gas to produce a Light of 13·6 Sperm Candles, burning 120 Grains per Hour.

One pint of oil lasts four hours, and costs 2·25d.	16 cubic feet of gas, at 3s. 9d. per 1000 cubic feet, costs 0·67d.

Oil more than three times the cost of gas.

In each of these tables the results obtained have been with the best refined oil at 1s. 4d. per gallon, and with the best burners and cottons.

If inferior oil, in which the risk of explosion is much greater, had been used, the result would not have been so good in amount and duration of light.

It must be clear from these tables that ordinary coal gas is much cheaper than petroleum oil.

But there is another scheme for lighting railway carriages, and by this it is proposed to light all trains in Great Britain with rich oil gas made from petroleum or shale oil, and compressed into cylinders at a high pressure. This plan has been reported upon by a committee of the Society of Arts, consisting of Professor Abel, A. Beattie, A. Cassels, Lord Alfred Churchill, Major General Wilmot, Myles Fenton, and J. Tomlinson.

The society offered a gold medal for an improved lamp, or means of illumination suitable for railway passenger carriages that shall produce a good, clear, steady, and durable light.

Twelve competitors presented themselves, some with oil lamps and some with gas.

It appears that Professor Barff occupied two days in testing them all, and having rejected most of them, the final selection fell upon a high-pressure system, which is described in the society's report as follows:—

"It appears that the gas is produced by a simple and not costly apparatus for distilling shale oil. It is then compressed to the extent of ten or twelve atmospheres, and stored in metal cylinders. A supply sufficient for use during 30 or 35 hours is, as required, taken into light wrought-iron holders at about six atmospheres pressure, fixed beneath the carriages. The cylinders are provided with an ingenious arrangement by which the pressure is regulated and equalized, and the gas allowed to issue and supply the burners. The gas is burnt through a small fishtail burner placed beneath and close to a convex reflecting surface, in which a small slot is made to admit of the passage of heated air to the chimney."

The result of the trial made by the Metropolitan Railway Company, extending over a period of three weeks working, shows that the gas can be produced at the rate of 16s. 5¾d. per 1000 cubic feet, and that the consumption per light per hour is 0·5983 of a cubic foot.

"Coal gas for lighting," says the report, "and not compressed, as in use at present on the Metropolitan and District Railways, costs only 3s. 9d. per 1000 cubic feet; but its consumption is, in round numbers, at the rate of 4 feet per hour, instead of six-tenths of a foot—that is to say, it takes 6500 feet of coal gas to do the work which 1000 feet of the Pintsch gas accomplished, at a cost of 24s. 4½d. for the former, as compared with 16s. 6d. for the latter. There is also with Pintsch's lamps a saving in the number of men employed, including those occupied in manufacturing the gas; and this may be taken in the proportion of five men in the one case, as against 18 in the other."

It must, therefore, be assumed by the report that gas of an illuminating power of 89·3 candles per 5 cubic feet can be made for 16s. 6d. per 1000 cubic feet.

The report says nothing about the cost of compressing it into cylinders at eight atmospheres of pressure.

The estimate just given of the illuminating power of the gas is founded on the assumption that 16-candle gas had been allowed to give only a part of the light it is capable of doing—viz., 10 candles per 4 cubic feet of gas, averaging 17 candles per 5 cubic feet.

If the coal gas had been burned in an Argand burner as good as the Gas Referees burner, giving 3·2 per cubic foot (and there are many thousands of commercially made London burners in use by consumers which give 3·4 per cubic foot of 16-candle gas consumed, or 13·6 candles for every 4 cubic feet of such gas), then 1000 feet of the Pintsch oil gas must, to do what is stated by the committee, have been equal to 113·3 candles per 5 cubic feet.

It is unfortunate that in the report of the committee no indication of illuminating power is given; so that it is only possible, by going into such calculations as I have shown, that this important point in relation to price can be discovered.

If the basis upon which the committee have founded their calculations has been the true value capable of being produced from the two gases, a very important field of inquiry to gas engineers is at once opened up. For, if oil gas of either 89·3 candles per 5 cubic feet, or better than that of 113·3 candles per 5 cubic feet consumed can be produced for 16s. 6d. per 1000 cubic feet, then I presume it will become necessary to seriously consider whether it cannot, with advantage, be made use of for the supply of towns.

But it is curious that we, to-day, find ourselves in the city which was for years lighted with oil gas, and, nevertheless, ordinary coal gas has replaced it.

Rich compressed gas, regulated down to burning pressures, in a manner similar to that described in the Society of Arts report, has been for many years made and sold in Paris by the *Compagnie Générale du Gaz Portatif*, and many houses and factories are supplied with it, but it does not there successfully rival ordinary coal gas at 6s. 9d. per 1000 cubic feet. Made there on a large scale, it is probable that it is produced cheaper than would be possible on a small scale, and yet ordinary coal gas, delivered at low pressure, is gradually pushing it out of the market.

The portable gas supplied in Paris used to be made of Boghead cannel coal, until this fancy coal rose in price to such a degree as to prohibit its use as a gas-making material. It is now probably made of Lesmahagow or some other cannel coal, but the illuminating power of gas made from Boghead never commercially exceeds from 35 to 40 candles, and Lesmahagow only reaches 25 to 28 candles. Oil gas, made in the ordinary way, never exceeds from 40 to 45 candles, and, as a rule, will not stand much compression without great loss by condensation. It is, therefore, difficult to understand how oil gas, even from petroleum, can be made for 16s. 6d. per 1000 cubic feet, of so rich a quality that 6-10ths of a foot per hour will give the light of even 10 sperm candles.

Besides, such a high quality of gas would scarcely burn in such a flat-flame burner as that which is used in the lamps supplied with the oil gas in the trains running on the Metropolitan Railway.

There are several coaches fitted with the high-pressure gas running between Baker Street and the Swiss Cottage. They are each fitted with two cylinders of iron, fixed under the bottom of the carriage. Each cylinder has a cubical capacity of about 5 cubic feet. A well-made screw-down cock is fixed on to the side of the carriage, near the step, and is connected by two ¾-inch iron pipes to the ends of each of the cylinders. This cock serves for the supply of the high-pressure gas to the cylinders.

A small pipe leads the gas from the cylinder to the governor, and from thence another small iron pipe conducts it to the lamps, which are fixed in the middle of the compartments of the coach.

This lamp does not greatly differ from the ordinary oil-lamp in form. The reflector, however, is slightly convex instead of, as in the usual form of lamp, concave. A small flat-flame burner may be said to replace the wick of the oil-lamp.

The flame of the lamp is small and bright, about 1¼ inch high and 1 inch wide, but it does not appear any brighter than ordinary cannel gas of 30 or 40 candles. Of course it is difficult to judge by the eye, with anything like accuracy, of the quantity of gas consumed, or of the value in sperm candles of such a flame, but the compartment does not present the appearance of being illuminated to the extent inferred from the report of the committee.

Test made June 2, 1877, with good sight.

Evening Standard, 8th page.—Smallest print not legible.
Next size, "Births, deaths," &c., not legible.
Ordinary matter, with difficulty.
Headings of paragraphs, easily.
In first-class compartment, lighted by two burners.

In fact, neither in Belgium, France, nor London has it appeared to the writer that the rich gases supplied from high-pressure cylinders show better practical results in lighting rooms or railway trains than ordinary coal gas supplied at low pressures.

As to the question of cost, the information given in the Society of Arts report, silent as to the illuminating power of the oil gas, and to its mode of manufacture, does not, in the opinion of the author, conclusively show that it is cheaper to use oil gas at 16s. 6d. than 16-candle gas at 3s. 9d. per 1000 cubic feet.

Therefore, although in such places as Russia and parts of Germany, it becomes a necessity to compress the gas into cylinders at very high pressure, because of the impossibility of obtaining a fresh supply excepting at very long intervals; yet, in the United Kingdom, where there is no difficulty in obtaining a supply of gas at low pressure in every town of any size, there can be no advantage in compressing the gas. No train in the United Kingdom runs longer than two hours without stopping, and a sufficient quantity of gas can be conveniently stored in the train under the low pressure of 5-10ths of an inch to supply all the lights required.

For many years the Metropolitan Railway, the Metropolitan District Railway, the North London, Great Northern, and other lines, have had trains running on their lines lighted with ordinary coal gas, and it has been found easy of application and efficient in working.

There are two modes of storing low-pressure gas in trains—both of these modes have already been mentioned in papers read before this Association—viz., one by Mr. J. T. Hall, then gas superintendent to the North-Western Railway Company, at St. Martin's Hall, in May, 1866, and the other by Mr. John Johnson, at Leeds, in June, 1875.

In Mr. Hall's paper the system originally adopted by the North London Railway was shortly described.

The company carries the gas for the train in the brake-vans. The gasholders are 6 feet square, and made of double india-rubber cloth one-eighth of an inch in thickness. The cloth is covered with rubber and folded together, the rubber being in between, sandwich fashion. The sides are kept in form by flat iron ribs ¾ by 1¼ inch, covered with canvas, and hung by tapes. It contains about 120 cubic feet of gas.

There are 36 lights in a train of 10 coaches, each coach is 28 feet long, and they are sometimes divided into compartments, as in first-class coaches, or open throughout their entire length, as in the second-class coaches.

The quantity of gas consumed in each lamp is about 4 cubic feet, and it is burnt through a fishtail burner.

The method of charging the gasholders described in Mr. Hall's paper in 1866, consisted in filling a large cylindrical boiler with water, and then allowing the water to run out, and thus draw in the gas. Afterwards the water was allowed to run into the boiler again, and the gas was compressed into about one-third of its bulk under considerable pressure, sometimes even as much as 30 lbs. to the inch. Then it was conveyed a considerable distance—about 60 or 70 yards—in a 2-inch pipe to the train. At the end of this pipe an india-rubber and canvas ply hose, having a diameter of 1¼ inches, or thereabouts, and about 60 feet long, was attached. The other end of the hose had a nozzle-cock with the nut and lining part of an union on it. The corresponding part of this union was fixed to another nozzle-cock projecting from under the end of the coach. The coupling having been made and both cocks opened, the gas rushed into the gasholder with considerable noise, and it was filled in about six or seven minutes.

This system very nearly ruined the success of lighting trains by low pressure, and prevented, there can be no doubt, the adoption of gas in many cases. The quantity of water used was as much as the gas; the extreme pressure in the boilers caused the gas to be driven into the water, and destroyed the illuminating power to a very great extent.

More than this, the boiler was absolutely useless, because the gas would have gone into the train gasholder, as well as it does into any other holder at ordinary pressures, if it only had been fitted with pipes large enough. But in all new processes and applications it is next to impossible to find the right way the first time.

The boilers have long since disappeared, and gradual improvements have been effected in the mode of filling the gasholders, until within the last two years the railway company have, in co-operation with The Gaslight and Coke Company, adopted the system of large supply-pipes to the gasholder, and the self-opening and closing valves, invented by the writer of this paper.

In each of them the valve is formed of vulcanized india-rubber made in the form of a cup, and so arranged as to have a cushion of gas behind the rubber, so that, when it is closed by the spiral spring, this soft cushion adapts itself to every part of the seat, making a perfectly tight joint, and the pressure of the gas itself assists in fitting the cushion to the seat.

At the mouth of each of the valves is a projecting buffer, which forms part of the closing cushion. These buffers are adjusted to such a length as to meet each other when the hose and carriage valves are coupled up, and retain both of the valves open. The coupling action is a simple three-threaded bayonet catch. About one-eighth of a turn draws both valves together, and squeezes a washer in between them, so making the junction gas-tight during the process of filling. When the holders are full, a slight turning movement the other way uncouples both valves; they spring away from each other, and the valves are both closed.

The operation of filling the holders at each end of a North London train takes 1½ minute with 2 inches pressure on the main. So that the filling operation is reduced from eight minutes with a 6-inch pressure to 1½ minute with a 2-inch pressure.

The present gasholders are very heavy, but if they were made in accordance with the principles described further on, so as to give a pressure of only 6-10ths of an inch, instead of more than 12-10ths when full, then they could readily be filled in about two minutes with a 1½-inch pressure on the main. They could also be filled at any station under the day (or 8-10ths) pressure in about eight minutes. No gasholders, boilers, or other apparatus would be required.

It must be noticed that trains on the North London line do not require filling at intermediate stations, because they hold enough to enable them to make a complete journey from one terminus to the other. Supposing they were running over greater distances, they could easily take gas at the principal stations. On long journeys, the stoppages are always much longer, and, therefore, the supply at ordinary pressures is much easier. It is only necessary to make the gasholder sufficiently light to lift at about 5-10ths to 6-10ths pressure.

The other system of storing low-pressure gas it that adopted on the Metropolitan and Metropolitan District Railways. The gas for each coach is carried on the top.

The gasholders are long bags of vulcanized india-rubber cloth, with rubber between, as before described. They are 40 feet long, and are provided with vulcanized india-rubber cross-ties or stretchers, to keep the sides of the bag in position when they are filled with gas. The roof of the bag is covered with a sheet of iron for nearly its whole length, to give it pressure.

Originally they were filled under a pressure of 9 inches of water. The process adopted was that described in a paper on "Railway Lighting," read by Mr. Wood, of Bury, in May, 1866, to this Association. A large gasholder, capable of holding enough for the supply of two trains, was weighted so as to give a pressure equal to about 12 or 14 inches. Instead of being counterbalanced, this holder was provided with a powerful crab and chains, so that two men could lift the holder and suck in the gas from the street-main.

Two of these holders were fixed at the Moorgate Station, and two more of the same kind could be seen till within the last two or three years at the Mansion House Station of the Metropolitan District Railway. The suction on the mains when the gasholder was being filled was felt very much in the neighbourhood, and Mr. Johnson, the chief inspector of The Gaslight and Coke Company, was obliged finally to have them put out of action. He then laid down larger mains both at Moorgate Street and the Mansion House, and the trains have since been supplied with gas without the use of these holders.

From the gasholder a 4-inch main, with branches, conducted the gas to each of the platforms. Hose-pipes, 20 feet long and about one inch in the bore, made of very thick vulcanized rubber, were placed at frequent intervals to supply the gasholders on the coaches.

Each coach had fixed at each end an inch pipe with a sharp elbow in the form of the letter L, the lowest end of which was supplied with a brass cock, with a bayonet-catch for the purpose of taking the gas from the level of the platform into the gasholder. Each of the hoses was provided with another and similar cock, with a nut to fit on the bayonet-catch of the cock fixed on the coach.

The method of filling was to attach the hose-cock to the coach-cock, and turn on both. In about from 7 to 10 minutes, when the gasholder was full, both cocks were shut and the hose withdrawn. A key was chained to the hose-cock to enable the attendant to open them.

At the time these expensive and troublesome gasholders were at work, the writer ascertained, by means of a pressure-gauge, applied at different points of the main from the gasholders up to the coaches, that, in consequence of the smallness of the main of the charging-pipes fixed to the coaches, the high pressure of from 9 to 12 inches dwindled down, during the filling of the trains, to less than 1½ inch on the L-pipe leading from the level of the platform to the top of the coach; so that, even at that time, the train gasholders might easily have been filled at a pressure of 1½ inches, in exactly the same time as they were filled under a 9 or 12-inch pressure, if the mains had been large enough.

Gradually these obstructions have disappeared, and now each coach is supplied with the patent self-opening and closing valves, and a 2-inch pipe, without sharp elbow, replaces the old 1-inch pipe. A 9-inch main with 4-inch branches at frequent intervals on each platform conducts the gas to the coaches. The hoses, which are now tapering from 4 inches to 2 inches and 7 feet long, are fixed on swivel joints, with mercury seals and each hose is provided with a hose-valve, with a ball and socket joint to it, so that it can be readily turned when making and breaking the connexion with the coach-valve.

The method of filling is simply to take up the hose, which hangs just under the platform, by means of a chain attached to the valve. Insert the nozzle into the coach-valve, and a slight twist to the right fixes it there, and at the same time opens both the valves.

The operation of filling lasts about one minute, during which time 120 feet of gas are sometimes put into the holders. Then a slight movement in the other direction disengages the valves and closes them. When a train of seven coaches is being filled in one minute, the demand for gas is at the rate of 840 feet per minute, or 50,400 feet per hour.

A wet meter capable of passing 10,000 cubic feet of gas per hour at ¾-inch pressure measures the gas supplied, and the pressure on the main varies from 5 inches to 2 inches. Of course with a 2-inch pressure the time required for completely filling would be about 2½ minutes. There are also filling arrangements exactly similar to this at Aldgate and Liverpool Street. The Mansion House Station is now nearly fitted with large mains and hoses. The principal meter at the Mansion House Station is a wet meter, capable of passing 15,000 cubic feet of gas per hour, at three-quarters of an inch of pressure. The pressure there at present is 6 inches direct from the Beckton main, but it will be reduced to 2 inches when the works are finished and all the trains are fitted. On each coach on this line there was the same small cock and filling-pipe as those on the Metropolitan line, and those have nearly all been removed, and large valves put in their places.

There still, however, remains an impediment to rapid filling—viz., the entrance to the gasholder itself is a 1 or 1¼ inch hole, so that although there is a 2-inch pipe leading up to the holder, the gas is restricted at the penultimate point by an opening which is very small. This will not be remedied probably for many years in the old coaches.

Thus the filling of the gasholders has been amply provided for. There still remain, however, some improvements to carry out before the system of lighting by low-pressure gas can be stated to be fairly tried. The first of these improvements is the substitution of a new kind of gasholder for the india-rubber bags at present in use.

The main defect in the present bags is that they *don't* hold the gas. The vulcanized india-rubber and cloth permit of the diffusion of the illuminating constituents of the gas, through the pores of the material, and the consequent mixture of atmospheric air with the gas in the bag. Thus, in a short time, the quality of the gas is much deteriorated. When the bags are new, they appear to absorb the illuminating constituents very rapidly; in about two hours 16-candle gas is reduced to 10 or 12 candles, and, if left in all night, all the illuminating power is lost. But, after they have been in use some time, they do not affect the illuminating power much in the course of an hour or so, but still, when they are left full all night, the gas looks ghastly in the morning. It is a matter of regret that such an influential committee as that appointed by the Society of Arts did not go more fully into the question of lighting by low pressures, and ascertain under what adverse circumstances, in comparison with its rival, the gas at low pressure was being employed, before utterly condemning it in the manner they have.

The remedy for this destruction of the illuminating power is, in the opinion of the author, the employment of gasholders made (as invented and patented by him) almost entirely of varnished wood and zinc. The flexible are of pure india-rubber sheet, 3-32nds of an inch in thickness, placed between very close-grained sheep-skin leather. The sheep-skin is prepared without oil, and the flesh side is coated with a solution of india-rubber in naphtha. The sheet-rubber is placed on the leather thus prepared, after itself having been likewise so treated. It is then rubbed or rolled down, and adhesion is perfect; the upper side is then similarly treated, and another skin is placed above it. No effect appears to be produced upon it by either rich gases or ordinary coal gas. A new holder charged at night with 16-candle gas was found in the morning to have suffered a loss of only half a candle in the illuminating power. This was, in all probability, caused by the absorption of some of the hydrocarbons amongst themselves.

Thus for the storeage of the gas. Next as to pressure. The present gas-bags in use on the Metropolitan and District Railways give from 9-10ths to 12-10ths of an inch of pressure.

The new gasholder described will only give 5-10ths of pressure, and that pressure is always uniform from the moment it commences to lift till it is full. The entrance of the gas is then shut off automatically by the inlet-valves.

With such a pressure any gasholder can be rapidly filled at any station on a railway line, where a supply of gas can be obtained under the usual day pressure of 8-10ths of an inch.

Next as to the lamps. Improved burners would give a very superior steady light. Unfortunately, it is at once assumed as a certainty that flat-flame burners *only* can be employed; *no chimney* can be used. Why not? On the French and German lines almost every tail light is provided with a chimney, and a great many of the roof lights also. They are there employed in order that the best light may be developed from the oil that is burnt. Why is it necessary to waste oil and gas in this country more than it is abroad? Why, if the light of 13½ sperm candles can be got out of 4 feet of 16-candle gas, should the public be forced to put up with 10-candles or even less than that.

Surely, the increased comfort and utilization of the gas will be worth the expense of a chimney, which need be only a very short one. If railway lamps are required to work with chimneys, inventors will soon be found to supply the demand. But why should every light waste 3½ candles of its illuminating power?

But if it is, and must be, a *sine qua non* for the present, that a flat-flame burner should be employed, then let it be a flat-flame which will develop the best light from the 4 feet of gas consumed.

If every railway-coach had, waiting a better one, a light in it equal to even 10 sperm candles, the public would be much better satisfied, and the tedium of railway journeys would be materially alleviated. So that what could really be done for railway coach lighting by the proper use of low-pressure gas is this—viz., gas could be taken from any station on any line where gas is burnt, without the aid of other apparatus than the pipes to conduct it to the coaches. A supply for two hours or more might easily be carried by every coach without interfering with the paying space, and only by increasing the weight of a 20 feet coach by 5 cwt.

By the use of an Argand roof lamp, a light of 13½ candles could be obtained, and a good reflector used to distribute this light well over the interior of the coach. Or by using a good flat-flame burner, 10 to 11 candles light might be obtained.

By the Argand burner any quality of gas might be consumed without difficulty. Thus a train might be charged in London with 16-candle gas, and at Liverpool with 20-candle gas, and at Edinburgh with 30-candle gas, and all could be used in the same apparatus equally well. The gas can be stored without deterioration for sufficient time.

Can the like advantages, at the same cost, be secured by the use of oil gas compressed at high pressure? The author ventures to say certainly not, for the following reasons:—

1. The gas is costly, and not proved to be permanent.
2. Special apparatus must be provided to make the gas, and it will not always be convenient for a railway company to make it.
3. Steam-engines must be employed to compress it.
4. Cylinders, in the nature of high-pressure steam-boilers, must be employed to contain it, and they must be used at 120 or 130 lbs. to the inch; consequently will require frequent proving.
5. The number of filling-places at a station must be very much restricted for fear of the possible heavy loss by leakage. In large stations, where many trains are required to be filled at once, this would be a serious difficulty.

And, lastly, such rich gas as only can be employed on the high-pressure system will not be found to develop the light of even 10 candles from 6-10ths of a cubic foot of gas, and so cannot advantageously compete with coal gas for lighting stations. Railway companies using this mode of lighting their trains, and manufacturing their own oil gas, must then have two systems of lighting at all their large stations—viz., 14 or 16 candle gas to light the station, and oil gas to light the trains.

If rich gases must and only can be employed, then they could be supplied and carried as well without compression, more easily on the low pressure system, as described, than upon the high pressure system. Gas companies on the lines requiring such gas could manufacture it from cannel coal, and deliver it into the gasholders of the coaches at a much cheaper rate than it could be made from oil, and compressed by any railway company.

This subject of supplying railway trains with gas is worthy the attention of all gas companies, and an earnest co-operation between them would enable the system of low pressure supply to be carried out all over the United Kingdom; and, as a result, the public would be much benefited, and the use of gas extended. A railway coach would be quite as good a customer as many small consumers burning five or six lights, and certainly would not give so much trouble in repairs of meters and services as a consumer. The only thing required would be the laying down of pipes large enough to supply the filling-places.

Mr. Warner (South Shields) wished to make one remark with regard to the new form of holder constructed by Mr. Sugg, which was unquestionably the best he had ever yet seen. It took him back in recollection to Samuel Clegg's first gasholder, which it resembled, with the exception that he employed a float at one end. If it was supposed to be placed upright instead of vertically, it would be something like Clegg's collapsible holder. There could be no doubt that, whether for the sake of holding or measuring stock, the smallest amount of flexible material was in every respect the best, just the same as with the dry meter. Mr. Sugg combined the two great advantages, the minimum of flexible material and the maximum of capacity. His was a combination between that which was known as Croll's diaphragm and Defries's diaphragm, and unquestionably, if flexible holders were to answer, it would be in this form—large plates forming a chamber of adequate capacity with a small amount of flexible material. The other arrangements exhibited in this apparatus appeared to him to be beautiful in their simplicity. Pintsch's regulator carried him back several years, when some such regulators were employed for working out at high pressure.

Mr. Goddard (Ipswich) said the question of lighting railway carriages with gas was one of considerable importance in a commercial point of view. One great difficulty which had hitherto arisen from the use of a flexible diaphragm was the injurious action of the gas upon the material. Mr. Sugg had provided against that by placing the india-rubber between sheets of prepared leather. So far as this Association was concerned, an interesting question arose as to how far gas companies would be disposed to meet the requirements of the railway companies, in order to make this plan of illumination for railway carriages universal. Of course, unless the railway companies could be assured of having facilities from the gas companies that these vessels should be inflated at certain stations, any proposal of the kind would be inoperative. He (Mr. Goddard) had been informed that the amount which was paid by the Metropolitan Railway Company to the Chartered Gas Company was something like £25,000 a year. If gas companies could increase their consumption by supplying railway trains with gas at their various stations, it was a subject which ought to occupy the attention of gas managers, with a view to see what facilities they could offer to induce railway companies to adopt the system.

Mr. C. Woodall (London), in response to a call from the chair, said he had very little indeed to contribute to any discussion upon this subject; but he thought he ought to say at once that, as the representatives of gas companies on this occasion, he considered they owed very much to Mr. Sugg for opening up to them this new field of business, and that they ought to express their obligations to him, not only for the labour he had gone through, and the amount of intelligence he had brought to bear upon the subject, but also for having contributed the very valuable and interesting paper that had just been read. He considered that the proposition Mr. Sugg had made to do away with the high-pressure system of filling the gasholders of railway trains was a very excellent one. The majority of companies would hesitate for a long time, and would require strong inducements, before they consented to erect at railway stations the necessary plant to fill the cylinders at higher pressure than was available from the street mains. But with this arrangement the whole expenditure was very slight, and involved only the laying down of a line of pipes, with some possibly expensive—but he should judge not very expensive—valves, and he should conclude that the revenue to be derived therefrom would be certainly enough to justify such an expenditure. Probably the railway companies, however, would consent to pay an increased price for the gas, if it was found impossible, with this added expenditure, to supply it at the price ordinarily charged to consumers. At any rate, it would be refreshing if gas companies were able to supply railway trains universally with gas, and should come to be looked upon as beneficiaries to the public, instead of being grumbled at, as they too often were at the present time.

Mr. Irons (Gosport) said it was rather more than 20 years ago since he had his first experience as to the proper material for holding gas. The first occasion was in connexion with the inflation of a balloon with gas from the works of the company now represented by Mr. Woodall. From some cause the balloon did not go up, and the next day it was found the gas had lost all its buoyant quality. On another occasion he was called upon to supply a light on board the *Agamemnon*, which vessel had been lent by the Government for laying the Atlantic Cable. The work of storing the cable required much haste, and a flexible hose was employed for conveying gas on board. Owing, however to the texture of the hose, it was found impossible to get anything more than a blue flame from the gas. Wrought-iron and gutta-percha tubes were afterwards adopted, and they were able to furnish so satisfactory a light that the work could be carried on during the whole of the 24 hours. For nearly 20 years his company had been satisfactorily supplying gas to a floating vessel in Portsmouth Harbour, with no more than the ordinary pressure in the street mains.

Mr. G. E. Stevenson (Peterborough) did not know what the gas companies could do to induce the railways to adopt this mode of lighting. It was their duty, however, to be ready when called upon to make immediate provisions for furnishing a supply. He had attended a meeting called by Mr. Sugg, at the Westminster Palace Hotel, when he was thinking of introducing his system upon the Great Eastern Railway. Mr. Sugg stated that a 3-inch main was required on the Metropolitan line, and that the gas had to be supplied to the carriages in one minute. He stated also that each gas-bag upon the carriages contained about 75 cubic feet of gas, and that they might reckon 1000 cubic feet was required per train of 10 or 12 carriages. It was explained that, in provincial towns where trains stopped some ten minutes or a quarter of an hour, it would not be necessary to supply gas at such a speed, and, therefore, such large mains would not be required. He (Mr. Stevenson) had examined the question for himself, with reference to Peterborough, and he found that if the system were to be adopted by the Great Northern Railway Company, the gas company would probably have an increased consumption of five or six millions per annum from this source alone. With such prospects, it was clearly the duty of gas managers, situated on large trunk railways where a number of passenger trains passed daily each way, to make every provision for carrying out this system of lighting as soon as called upon to do so. The members of this Association were greatly indebted to Mr. Sugg for his past exertions, and they would owe him still greater obligations if he could induce the railway companies to adopt his system.

Mr. Pearson having briefly described the nature of Pintsch's regulator,

The President closed the discussion. He concurred in the remarks made by the various speakers as to the obligations of gas managers to Mr. Sugg for the preparation of his valuable paper. All he could say about it—and that was the best praise he could bestow—was that it was very like Mr. Sugg. He was a most acute observer of what should be, and a most careful operator in everything he undertook. In the present case he had brought his great talents to bear upon the subject in hand with very great success. He (the President) was delighted with the material of the gas-bag exhibited, and would like to put one of the specimens in his pocket, but he feared that if he came across a pack of hounds he might be mistaken, from the smell of it, for an old fox. As to high pressure, he did not believe in it at all, and certainly never liked to apply it to gas. He could remember 45 years ago being familiar with this subject, in days when compressed gas was sent out in strong metal vessels, but he took it that the high-pressure days had now gone by entirely. The only thing they would have to deal with as gas managers was the application of the heavier oils—the oils which the house of Young and Co. and others did not know what to do with, and would perhaps sell at 1s. a gallon, and all of which could be used. He had some memoranda by him showing the economy and utility of the application of the heavy oils for railway carriage lighting by means of a lamp patented in France by J. Clark, of Paris, and in England in the name of Henry Gardner, patent agent, and the comparative value of this means of lighting, as against the ordinary lamp in use on the London, Chatham, and Dover Railway Company, was stated thus in a certificate given by a high authority in such matters. The common lamp with an 8-inch globe, and fitted with a 1¼-inch wick, gave a light equal to 2·75 candles; the patent lamp under the same conditions giving the light of 6·44 candles. The same patent lamp, fitted with an 8-inch globe, but fitted with a ¾-inch wick, only gave a light equal to 5·03 candles, while another trial with the same lamp, fitted with a 10-inch globe and a ¾-inch wick, gave a result of 9·8 candles. He only named these facts to show what they had to deal with as gas men, and to beat in the race. He apprehended it would be their own fault if they did not succeed. In the name of the Association he cordially thanked Mr. Sugg for the able paper he had sent to be read that day.

Mr. A. F. Wilson (London) read the following paper on

AUTOMATIC GAS LIGHTING AND EXTINGUISHING.

The test of the utility of an invention is its necessity; and it may be added that success will mainly, if not entirely, depend upon its economy and adaptability.

Convenience, it may be argued, is probably, in the present instance, a better term to use than necessity; still the meaning of the one really merges into that of the other term, not only with this, but with all improvements of proved utility. Convenience after a time becomes necessity. Use accustoms us to the facility, and after a short interval, "indispensable" takes the place of the first and more doubtful expression.

Even the strong word "necessity" might, however, the writer thinks, fitly be applied to the impelling motive which first directed his studies in this direction. Companies having contracts for public lighting (foreign companies especially) are in the power of their *employés* in this branch of their business, almost more than in any other, and as is almost invariably the case where contracts are particularly specific as to the time of lighting and extinguishing, under penalties which in the aggregate become onerous, these penalties are imposed unjustly, without the company having the power satisfactorily to disprove the imposition. The writer knows of at least one instance where an inspector of public lighting was in the habit of formulating a daily list of fines, without troubling himself with the ceremony of inspection; and where redress was only to be obtained as a favour of the authorities, they could legally refuse to receive the evidence of a servant of the company, but the writer does not think they could, or at least would, have disputed the evidence of a register worked by an automatic action applied to the general lighting and extinguishing of the lamps.

Passing from the necessity or convenience of some such arrangement, the next consideration is that of "economy." It is evident that the expense of working the new system must not certainly exceed that of the old; there must even be a considerable monetary advantage to overcome the *vis inertiæ* of a change, and it may also be assumed that, in such a calculation, indefinite or hypothetical factors would not, in the majority of cases, be taken into account.

We are thus brought face to face with what is assuredly not the least important question in the minds of those who have given the matter thought, or who are called upon to contemplate it. Will automatic lighting and extinguishing pay? Theoretically, so far as figures can prove a case, the writer believes it will, and he relies upon calculations based upon ordinary experience to bear out his opinion, without searching further afield in fictitious values of advantages which can easily be imagined in order to strengthen his case.

Adaptability, again, is a *sine quâ non;* it is not sufficient that an apparatus be produced, which, under certain and unvarying circumstances, would perform the duties assigned to it. A machine is wanted which, within a fair limit of varying and uncertain circumstances, will act satisfactorily, if not absolutely perfectly, the degree of perfection necessary being fairly assumed as that attained under the present sytem.

The points aimed at, therefore, in this paper, will be—1. The convenience of an automatic system of lighting and extinguishing public lamps. 2. The economy of such a system. 3. Its practicability. 4. The degree of

success or adaptability to be expected from the apparatus patented by Messrs. Flürscheim and Baumeister for that purpose.

It is stated that Napoleon eliminated the word "impossible" from his vocabulary. Our highly respected President has lately assured us, in a communication to the JOURNAL OF GAS LIGHTING, that he does not acknowledge the term "failure," and, as a rule, the writer has a firm faith that if, working upon practicable lines, we only keep "pegging away," success is sure, sooner or later, to reward our efforts. Still, as generally understood, the word "failure" is in many instances applied to what is really a step towards success, and, in this sense, the writer is not ashamed to own that he is one of those who have failed in perfecting such an apparatus as is here referred to. He is rather pleased to think that he has, in however slight a degree, contributed something to it, as the patentees do not deny, and, indeed, one of them has acknowledged to him, that their ideas proceeded from, and are in many essential parts simply perfections of, his own, with, he is bound to add, important additions, the want of which fatally interfered with the adaptability of his apparatus. Failure, in this case, does not, he thinks, point a moral as "something to avoid," but rather "something to improve upon," and in acknowledging that from other and well-known sources, he himself obtained several valuable hints, he is happy to find himself in honourable company, aiding at least, in some degree, the construction of the building, if without the honour of placing the topmost brick of the completed edifice.

Apart from the uncertainty attending the maintenance of a large body of men, each of whom must be trained in the knowledge of a certain district, often intricate and extensive, and who, in the event of sickness or other cause, being prevented from attending to his duties, must be substituted by another, equally well informed, there is in many parts—although, fortunately, not to a great extent in England—often a difficulty found from bad weather. In the tropics, and especially there about the hour of sunset, when it is time to light up, rain sometimes falls in such torrents, and continues so to fall for such an interval, as to make it almost impossible to prevail upon the men to face it; consequently delays occur, giving opportunities for the infliction of fines, which are frequently heavy and always disagreeble. Again, the men are occasionally mutinous, combining amongst themselves to enforce terms beyond the fair market value of their labour, which extorted terms are afterwards difficult to reduce. The lighting is irregularly conducted, many of the most needful points being left in darkness long after light is wanted; and last, if not least, the extinguishing is often sadly neglected, lamps being left alight in many instances a considerable time after their light has waned before the more brilliant luminary of day. A difficulty is also sometimes felt where the lighting and extinguishing is regulated according to the different phases of the moon, and of one place especially, the writer has been told that it was necessary to keep the lamp-men locked up at night in a kind of barrack-room, ready to be called as the hours of lighting and extinguishing arrived.

The public lamps of the Metropolis cost, for labour of lighting, extinguishing, and cleaning, from 12s. 6d. to 15s. each per annum; but from this an allowance must be taken for cleaning, which it is not proposed to deal with otherwise than as at present. Lighting and extinguishing alone may, therefore, be counted at from 8s. to 10s. per lamp, a sum certainly not great in itself, but not at all insignificant, if calculated on the total number of public lamps in the City. Again, in order to fulfil the ordinary conditions of contracts controlling the lighting and extinguishing of public lights, the lighting must begin a considerable time before it is really wanted, and extinguishing must necessarily end long after gaslight is superfluous. There is, therefore, a waste of gas in this way, which is, probably, not at all exaggerated, if counted per diem at one hour's consumption of five cubic feet = 1825 cubic feet per annum, or, at 2s. manufacturing rate per 1000 cubic feet, nearly 3s. 8d. for each lamp. Adding to this 1s. 4d. for wear and tear of lighters, matches, oil, and other accessories, gives a total of from 13s. 6d. to 15s. as the lighting and extinguishing cost under the present system of working.

The expense of an automatic system would be—1. Interest on capital expended on the change and in the requisite apparatus. 2. Repairs from ordinary wear and tear. 3. Amortization of apparatus spread over a fairly estimated lifetime. 4. Cost of gas or other appliances necessary to work the arrangement. 5. Supervision and other labour, attending to any faults which might occur.

Treated upon a scale of ordinary magnitude, such an apparatus as it is now proposed to describe, including fixing, and deducting value as old metal of existing material thus rendered superfluous, would probably not exceed an original outlay of 20s. per lamp; therefore, 7½ per cent. taken as a fair annual interest would give 1s. 6d. under this head, calculating 1s. upon each as an average for repairs, 1s. 6d. for amortization on a lifetime of ten years, less value of re-usable material. Cost of gas for small jet at a consumption of half a cubic foot per diem, or, say, 200 cubic feet per annum, equal at manufacturing rate already quoted to 4·8d., and with other inconveniences (such as loss by leakage from pressure required for working) of, say, an equal amount, or together to 9·6d.; lastly, supervision and labour at 2s., or, to make an even sum, 2s. 2·4d., a total estimated expenditure is arrived at of 7s. per annum, or showing a saving as against the present mode of working of from 6s. 6d. to 8s. per lamp per annum = from £325 to £400 in a district containing 1000 lamps. Supervision is, however, the writer thinks, subject to correction in this calculation, where, as in the Metropolis, the number of lamps would greatly exceed the standard named. A staff of men must, under any circumstances, be kept for lamp-cleaning, and, with a little training, these men would be available for looking after and correcting minor faults; so that, if fair working perfection in the apparatus be attained, the extra pay for supervision would probably, after a little time, be found to be, if not insignificant, at most less than the amount which in the calculation is, without absolute data, assumed.

A desirable arrangement is often admitted to be possible, while yet no practical way of carrying it out may have been discovered. Again, this may, in a manner, have been attained, and yet not so perfectly as to meet all the varying circumstances which are liable to impede the working. Such, in fact, has been the position up to the present time; it is unnecessary here to rehearse failures. Several meritorious inventions for the purpose have been brought forward, but all have hitherto failed in practical working, either as containing within themselves the causes of premature decay and consequent disarrangement, or in failing to meet the necessity of adapting themselves to varying and, within limits, uncertain circumstances. Naturally, therefore, we ask ourselves, is the thing really practicable, and does this apparatus possess points in advance of others which have already been tried?

To save time, attention will be confined to the apparatus now under consideration, and the repetition of well-known and obvious details will be avoided. Inquiry may, therefore, properly begin with, and be mainly directed to, the difficulties which have hitherto been encountered, and which have baffled all efforts heretofore made for the attainment of this object. The motive power in opening and shutting the gas-way it may, however, be as well to explain, has, previously as now, been pressure, applied or withdrawn in the usual manner at the gas-works, and the lighting agent has been, as it now is, either an electric spark, or a permanent or intermittent gas-jet in proximity to the burner. Our attention will be confined solely to that lighted by the intermittent jet.

Pressure applied in the usual manner to the main-pipes is subject to what may be called a practically invariable, and also to decidedly varying alterations. The practically invariable is controlled principally by the difference of level, and by the specific gravity of the gas. The varying alterations are caused by the greater or less capacity of the mains in relation to the demands of consumers, and also to irregular draughts by large establishments, such as theatres, &c., during the hours of general consumption.

These difficulties were at first met by adjusting the lighting and extinguishing pressures of the appliance adopted, or experimented with, at a point which, regulated to the variations of level, it was supposed would, under all possible circumstances, be attained when lighting-up time came round, or to which it could with certainty be reduced when the lamps had to be put out. The points thus fixed, however, were so low, that it became difficult to extinguish many of the lights at the ordinary day pressure, and upon the slightest increase they were liable to be relighted, although not at proper lighting time.

London fogs are proverbial, and heavy day pressure being often thus especially requisite, of course such an arrangement was unsuitable to the lamps of the Metropolis. Besides, Metropolitan Gas Companies, as a rule, reduce the pressure considerably, shortly after midnight until close upon dawn, and necessarily the lamps are then intended to be kept alight as at other hours of the night.

An apparatus thus became necessary which would light at one pressure and extinguish at another, maximum and minimum points—an apparatus which, when once lighted, would remain so, although the pressure should be very considerably withdrawn, and which, when extinguished, would not re-light without increasing the pressure again to the maximum point.

These difficulties were overcome under a patent obtained by the writer in 1873, but others, and equally formidable ones, yet remained, and in overcoming these latter really consists the improvement attained by the present apparatus.

The general construction of Messrs. Flürscheim and Baumeister's apparatus is greatly superior to, and much more sightly than, that patented by the writer, and which may be called its immediate predecessor; but the main points of improvement, meeting obstacles experienced, are as follows, viz.:—1. The intermittent action of the small jet, alight when the principal flame is extinguished, extinguished when that flame is alight. This intermittent action diminishes the gas consumed by the lighting agent fully 50 per cent., and the illuminating power of the burner is undisturbed by the carbonic acid produced in combustion by the small jet, which was found seriously to diminish the brilliancy of the light. 2. The ratchet-wheel support action. This obviates the necessity of reducing to an inconvenient extent the pressure for extinguishing; for example, any serious diminution of pressure on a dark winter morning, in order to extinguish the lamps, would, doubtless, at the same time, seriously interfere with the arrangements of factories or other places requiring or desiring gaslight during even the short period which such diminution would necessarily take place, and thus probably complaints would result, which would lead to the abandonment of the system. 3. The introduction of a small, and at the same time efficient, governor inside the cup. This is one of the most important improvements of the arrangement, and without it, notwithstanding the ingenuity otherwise displayed, the writer does not hesitate to affirm that the rest would have been utterly useless.

Difficulties of a serious nature are, however, still to be looked for, in the insufficient capacity, in many instances, of trunk mains leading to distant and heavy consuming districts, and also to places of considerable altitude, or possibly both combined; and these must, to a great extent, be remedied or removed before the universal practicability of the new system can be guaranteed. The pressure in these districts is sometimes too invariable, day and night being about equal, or, occasionally, even reversed; the heavy pressure occurring during the day, and lightening off in the evening as the consumption gradually increases. Now a margin of difference is absolutely essential, otherwise, as already explained, there is a difficulty in extinguishing and too great a delicacy in re-lighting. The remedies demanded, it is in the interests of the companies, for other reasons, to apply. Larger trunk-mains to heavy consuming districts would, in giving consumers a better supply, legitimately increase the sale of gas; and where altitude interfered, district governors would check the day accumulation of pressure, and probably diminish leakage at these points. The question of practicability, so far as applied to the apparatus, is, by these latter difficulties, serious, though they be really untouched, and consequently faults in action, which are attributable to them, ought to be excused, as in such cases the duty of the company is to increase the size of their main-pipes, and to adopt appliances, where necessary, for the restriction of undue pressure.

The apparatus consists of a concentric cast-iron tank, about 2 inches diameter, attached, by a screwed socket at the bottom, to the lamp service-pipe. The space betwixt the concentric rings is a little over one-eighth of an inch wide, and holds sufficient depth of mercury to seal an inverted cup, which rises as the pressure is applied, or falls as it is withdrawn, beyond the lighting or extinguishing points. To this cup is attached the governor, which is exceedingly simple in construction, and regarding which, it will be sufficient to say that between limits of 8-10ths and 30-10ths of pressure it is found perfectly easy to adjust the consumption of gas within a marginal variation of less than 4-10ths of a cubic foot per hour. To the cup is attached a tube, which conveys the gas to the burners, and which, sliding in a closely-fitting chamber, alternately supplies and cuts off the large and small lights. This is managed by means of three orifices, and ringed indents in the tube, somewhat on the principle of the slide-valve of the steam-engine, the upper orifice supplying the large burner, and the two lower ones being for the service of the jet. The action is as follows, viz.:—When the inverted cup is at rest in the tank, the lower and smaller orifice in the tube is opposite a corresponding orifice in the casing leading to the jet, and an exceedingly small flame is maintained. As pressure is applied, the cup and tube rise, and the middle orifice is brought opposite its corresponding aperture. This allows a full supply to the jet, and the consequence is the production of a flame reaching to the burner requiring to be lighted. Continuing the pressure, the upper orifice gradually becomes free to the chamber communicating with the burner, which is then lighted, and the cup still continuing to rise at the time a full supply is given to the burner, the orifices communicating with the jet are both cut off, so that this is at once extinguished. Around the jet is a double wind-guard, which has been found an efficient protection.

Attached to the tank-cover outside is an arrangement of weights and counterpoises somewhat difficult to describe. The counterpoise is a variable lever-weight which causes a variation in the lifting and descending weight of the cup, so that when at rest it is heaviest, and when lifted gradually loses weight. The position of this counterpoise, or of the weight at the opposite end of the lever adjusts the lighting or extinguishing pressures of the apparatus.

Fixed to the ring of these levers is an arrangement of ratchet-wheel, camb, and rest. This is intended to support the apparatus after the

burner has been lighted, and, with an alternate action, to withdraw such support when it is desired to put out the light. A cover enveloping this part protects the mechanism from dust or other injury, and neatly fills the space between the top of the tank and the jet wind-guard.

Reverting to the description, finishing the action of the slide-tube, the burner may now be supposed to be alight, and the jet extinguished. The next action is to withdraw a little pressure, by which the cup descends a little, but is prevented, by the ratchet-wheel falling upon the rest, from continuing the descent, and the pressure may then, at intervals as desired, be withdrawn as far as needful, without influencing the light.

To extinguish, it is necessary for a very brief interval to bring the pressure again up to the maximum point; this raises the ratchet-wheel off the rest, the camb brings it round a tooth, and in descending the rest slips into the space prepared for it. Again, in descending, the action of the burners is reversed. Before the large light is extinguished the aperture is free to the jet, which is relighted, and as the descent continues the middle aperture is gradually closed, and only the small orifice at the bottom remains to keep alight the now almost invisible flame.

An apparatus such as now described has been at work on the gate lamp of the South Metropolitan Gas-Works since August of last year, without giving any trouble or showing signs of deteriorated action. Twenty have for several months been placed in the Peckham and Old Kent Road districts of the same company, with fairly satisfactory results; 12 are on the district of the London Gas Company, 12 on that of the Phœnix Company, and the writer thinks 12 or upwards on that of the Crystal Palace Company, and in every case the engineers of these companies have expressed most hopeful opinions of ultimate success, combined with a more or less qualified satisfaction at the results so far demonstrated. No doubt hitches have occurred, but in scarcely an instance has it been impossible to trace the cause. A service had been imperfectly cleaned, and the pressure was choked off with naphthaline. Some one, from curiosity, or, perhaps, malice, had been meddling, or the pressure at the works had in some way been interfered with. Briefly summed up, the instrument is probably as perfect in principle as it can be made; but the intention is that it should be worked, not that it should keep everything right and work itself. All these minor defects or hitches which have been observed or have occurred are, to coin an expression, overcomable. It can be adjusted to great variations of pressure, it is reliable after adjustment, it interferes in no objectionable way with private consumption, and there is neither undue expense nor troublesome labour in working it. The real and, the writer thinks, probably the only important difficulties now lie in occasional mains of insufficient capacity, and in the absence of check-governors for greatly elevated districts, and these he hopes the companies themselves will have the sound sense to see their interests in remedying.

Mr. Livesay (Ventnor) said he was sorry that their friend, Mr. G. Livesey, was not present, as he had had experience in this system. Mr. Garnett, also, who was absent, had experimented upon it, as he (Mr. Livesay) had done to some extent. Every one who had had to do with the arrangements for lighting and extinguishing would agree with him that a better system than the present was desirable. In some towns he had seen the gas burning throughout whole districts after daylight, which, unless some such arrangement as that proposed by the writer was adopted, was almost inevitable.

Mr. Gandon (Sydenham) said his company (the Crystal Palace District Company) had had 18 of the apparatus described by Mr. Wilson in operation for the last two or three months, and he found them, as a rule, very successful. He was not prepared to endorse the statement of their success entirely, because there had been failures. For the last month the total number of failures amounted to 52, of which only 13 were failures in lighting, and the others in extinguishing. The governor was a most ingenious invention, and he found it perfect; two or three, which had been up for the last three months, had been taken down and tested, and they showed that there was not the slightest variation in the rate of consumption, the pressure having varied between 8-10ths and 30-10ths.

Mr. G. Anderson (London) asked whether the experience of the use of this apparatus in the Crystal Palace district had been that complaints were made by persons consuming gas, at the time when the increased pressure took place. It seemed to him that a sudden increase of pressure of three or four tenths would be very inconvenient to persons having Argand burners alight at the time.

Mr. Gandon said the company had not had any complaints of the kind. They were obliged, of course, to increase the pressure, but it was momentary, and as it was necessary to light the public lamps before the generality of the private consumers began lighting up, the amount of inconvenience was limited.

Mr. H. P. Stephenson (London) said some years ago he introduced to this Association an invention of his own for lighting the public lamps automatically, and he was in great hopes at the time that the system might be successful. The process consisted in the adoption of an air-tube, fitted throughout the district, and, turning the tap of the lamps on and off by means of pressure and exhaustion through this air-pipe, having by the side of the ordinary jet a small jet, which was burning all day long. That system acted exceedingly well when applied to 20 lamps, and for about a fortnight or three weeks, and so encouraging was the prospect that he began to look forward to making a fortune by the invention; but at the end of that time the taps began to get stiff, so that the pressure he was able to put on the air-pipe would not act sufficiently to turn them on, nor was the exhaustion sufficient to turn them off when required. He was, therefore, compelled to admit that the system, from which he expected so much, became a dead failure. He had still a very strong feeling that a system of automatic lighting must be such an one as would depend on pressure, apart from the main itself, for there seemed a considerable amount of difficulty in applying pressure in that way. In the first place, take the case of a fog arising; the pressure in the gas-mains would have to be put on all over the district, the effect being to light up all the public lamps, and who would pay for them? Municipalities and local authorities would not be likely to admit their liability for the extra consumption. Then, again, as Mr. Wilson had mentioned, there was the difficulty of supplying certain districts at certain times, and having to put on extra pressure there. In each of these cases there would be considerable difficulty if the pressure was supplied from the main. No doubt at present, as Mr. Gandon had explained, there had been a few failures, at times, with the apparatus brought before the meeting, and which had been put up in the Crystal Palace district; but probably these arose from local circumstances which might be got over. In any case, the adoption of the system would involve expense, and they must include in their estimates the cost of sending a man, or a boy, on a pony or a donkey, throughout the district continually, to see that all the lamps were properly lighted. He did not think any district would be safe, especially a large one, unless a messenger was thus employed. There was one point in which he thought Mr. Wilson had over-estimated the value of the system, and that had reference to the question of the quantity of gas consumed by the small jet throughout the day. He estimated half a foot only, which seemed a very small quantity to calculate upon. In his (Mr. Stephenson's) apparatus, the consumption by the small jet was something like a quarter of a foot an hour. While making these qualifying remarks, he was quite prepared to admit the ingenuity of the apparatus exhibited, and he sincerely wished that it might be found practically successful, as it would be of great advantage to gas companies.

Mr. Brett (Hertford) said he had made several trials with automatic lamplighters. He would like to know what were the consumptions by the small jets at all pressures. The one he had experimented with required 17-10ths pressure to light the top burner effectually before it went out itself, whereas the pressure might be decreased to 2-10ths, and the top burner would still keep open. On putting the gas out in the lamps the pressure had to be raised to 18-10ths before it took effect. There was one difficulty in connexion with such a system of lighting which must not be lost sight of, and that would arise in the case of some lamps having to be put out at one time and others at another, as was frequently down in country towns.

Mr. Hartley (Westminster) said he was one of those who recognized the fact that many advantages would attend an automatic system of lighting and extinguishing the public lamps. But it seemed to him that in connexion with this invention certain points had been overlooked. In the first place, it appeared to be taken for granted that the lamps to which the system was applied would always be regularly lighted at a certain specified time, and that there was no possibility of the small jet being extinguished. He had seen something like this before, and he was struck with the ingenuity of the instrument; but he fancied there was a possibility of the small jet going out, and also that though the pressure was turned on, there would be no flame at the burner. It would certainly, therefore, be desirable that such an inspection as Mr. Stephenson suggested should take place during the hours of lighting. There was also another point—here was a tube sliding within a cylinder, and, as they all knew, gas had an effect upon metals, and especially, if a little ammonia was present, it affected brass and iron. Supposing such an action to take place on these tubes, giving rise to resistance, and causing the tube to stick fast in the cylinder, or not to travel fast enough, or not to fall when required, one would like to know for how long a time such apparatus had been in use, and with what success it had worked after being in use for a considerable period. They had heard of something like 50 mishaps in the Crystal Palace district during the last month. If that were so, it seemed to indicate that there was imperfection somewhere which had yet to be overcome. He had no wish to discuss the invention antagonistically, but desiring, in common with all present, to see a better system of lighting adopted, he still felt that they must guard themselves from too readily accepting even so ingenious a device as that exhibited, without looking at the matter in all its bearings. It appeared to him that the saving to be effected had been over-estimated, and that they would not get rid of so many lamplighters as to give the economy indicated.

Mr. C. Woodall (London) said he had not intended to speak on this subject, but having been referred to by the author of the paper as having used a certain number of these instruments, and given an opinion as to their ultimate success, he felt it necessary to say a few words. While admitting that it was one of the prettiest things that had been introduced, he was bound to say that he was not conscious of having expressed a very confident expectation of its general adoption, though he had a hope that such would be the case. At the present time he could only feel regret that they were called upon to discuss the merits of the invention, before it had been sufficiently tried for members present to be able to speak with any degree of assurance respecting it. He had fixed about a dozen of them in the neighbourhood of the Waterloo Road, London, and the number of mishaps with them, either the lighters failing to light up at the proper hour, or failing to be extinguished in the morning, had been comparatively few. Perhaps out of the 12, the number of failures had been about 20 during three or four months. In order to see whether the difficulties attending the use of the apparatus were increased by the distance from the works at which they might be fixed, he had had a few put up at a distance of six miles from the gasholder station. With these he found the difficulties increased enormously. Probably these difficulties had arisen from matters within the control of the company to a certain extent, and having that feeling on the subject, he was very unwilling to mention these failures in lighting or extinguishing, as condemnatory of the apparatus. But there was the fact, and that was the reason why he regretted that a discussion had taken place respecting the invention before gas managers had had sufficient time to go thoroughly into the question to ascertain how far the failures hitherto experienced might be remedied in practice. He thought Mr. Anderson had alluded to one difficulty which might come to be serious. In the morning, at his own works, they had to increase the pressure to 25-10ths to extinguish the lighters. This was not an increase of 3 or 4-10ths, but from 5 to 25-10ths, which was material, and might, under some circumstances, prove very awkward. He thought, too (but Mr. Wilson read his figures so rapidly that it was difficult to follow him), that there was an over-estimate in the economy to be effected by any system of automatic lighting. He thought also that the quantity of gas consumed during the day by the small burner had been understated. Of course, in any invention of this sort (although that did not affect the merit of the invention) the benefit would accrue to the local authorities, and not to the gas companies. Whether that should make them more cautious in hastily entering upon a change of system he must leave his brother managers to determine.

Mr. Wilson, replying to the observations that had been made, said he did not think the meeting would expect him to offer, in respect to a comparatively untried apparatus, anything further than his own opinion on the matter. He would only say, therefore, that he was a thorough believer in it, certain conditions being given—viz., larger mains and careful attention to pressure. He was much obliged to Mr. Gandon and others who had spoken, for the favourable opinions they had expressed respecting the invention submitted to the notice of the Association. He did not think that even 50 failures in the district of the Crystal Palace Company in a month was a very large amount, considering that this was almost in the beginning of the history of the apparatus, and more in the nature of an experiment than anything else. With regard to what Mr. Anderson said, he admitted that it was a point that had struck his own mind very forcibly, but it was in the opposite direction. In the older apparatus it was necessary to reduce the pressure so considerably that it diminished the light in private houses to an extent which interfered with the comfort and convenience of the inhabitants. But he would scarcely anticipate the same difficulty from an increase of the light. In the first place, the addition to the pressure would be merely momentary, and might cause a little jumping of the light, but he did not think that would be any valid cause of complaint. Mr. Stephenson, no doubt, hit upon a necessary thing in connexion with the adoption of the system—viz., that it would require supervision. Whether a boy upon a donkey or a pony was employed or not, it was clear that it must be done somehow or other. He took in his estimate 2s. per lamp as the amount for supervision, and he believed it would not exceed that sum. With reference to the remarks made about foggy days and nights, Mr. Stephenson was under a misapprehension. Formerly, the pressure put on to meet the necessities of a foggy day would light up all the public lamps, but in this apparatus that drawback to such an arrangement was obviated, and, though pressure was necessarily put on during a fog, it would not necessarily light up the

lamps. As to the quantity of gas required by the small jets, it must be remembered that they were only burning when the large burners were extinguished, and not when they were lighted, and he thought, upon a careful examination, it would be found that the quantity of gas consumed would not exceed half a foot a day. Mr. Brett had referred to the difficulty in the way of the adoption of the system in small towns where the lamps were extinguished at different hours. He did not know how to overcome that difficulty, and, therefore, must suppose that the arrangement would not be applicable under such circumstances. Mr. Hartley had mentioned the possibility of the tube sticking in the cylinder. That was a very proper thing to take note of, and the only reply to the remark was that for nearly 12 months there had been an apparatus at work at the South Metropolitan works, and there had been no hitch of the kind. Upon the recognized principle that "facts are stubborn things," he did not think that anything more need be said in respect to this objection. Mr. Woodall's remarks exactly agreed with his own. Very extensive districts must have special arrangements made for them, or very large mains laid. At the same time he must remind the meeting that this was not a delicate apparatus. It might be adjusted to light at 10-10ths or 30-10ths, and possibly at 5-10ths; therefore, although note must be taken of these variations, it was not necessarily a delicate apparatus. If the companies would lay mains of ample capacity within certain limits, he believed it might be relied upon to do its work.

The PRESIDENT said the invention which Mr. Wilson had introduced was very ingenious, and it struck him that the inventor must be a very courageous man to venture to deal with, and spend so much time as he evidently had spent, over an apparatus from which he had so little hope of reward for the application of his ingenuity. The reasons against the adoption of the system were very many, and the difficulties in the way so great. Take the case of a sudden fog—that would in itself almost preclude the adoption of the system in London. Then the difficulty mentioned by Mr. Brett, where the lamps in a town were put out at different hours—some at twelve and some at two o'clock. At the same time one could not but admire the invention; it was so exceedingly pretty and ingenious, that, despite the difficulties in his way, one could not but hope that the inventor might ultimately see it extensively adopted, and the desirable end accomplished, of the public lamps being lighted at once when required, instead of within a time varying from an hour before to an hour after sunset. For the able manner in which Mr. Wilson had described and illustrated the invention, he was entitled to the thanks of the Association. One could not sympathize much with Mr. Stephenson, who failed to make a fortune by his invention, because he did not want it. Like many others, he had had to go without the reward of his genius, and to be content to regard his services as a labour of love. In the end, however, they might hope, notwithstanding previous failures, to see something like success attending the invention of apparatus for automatic lamp-lighting.

(To be continued.)

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

The Ordinary General Meeting of Shareholders was held at the London Offices of the Company, 60, Gracechurch Street, on Tuesday, June 26,—JOHN BIRCH PADDON, Esq, in the chair.

The SECRETARY: (Mr. E. P. Rowsell) having read the notice convening the meeting, the following report and statements of account were presented:—

The directors present the accounts for the year ending the 31st of March last. After writing off the final instalment of the preliminary expenses, and providing for interest on debentures and for dividends on the first and second classes of preference shares at the rates of 7 per cent. and 7½ per cent. respectively, sufficient remains to the credit of revenue to allow a dividend of 2¼ per cent. on the ordinary share capital, free of income-tax. The continued depression of commercial affairs at Malta has checked the progress of the company's business, but arrangements have been made for some additional mains, by means of which the sale of gas will be profitably increased. Mr. Samuel Andrews is the director who retires by rotation. He offers himself for re-election.

General Balance-Sheet, March 31, 1877.

Dr.				*Cr.*			
Capital: ordinary shares—				Outlay at the stations, as per			
£5 per share on 15,000 shares	£75,000	0	0	last balance-sheet . . .	134,567	17	7
Less discount on shares authorized, 1868 . . .	3,000	0	0	Expended since	671	10	0
	£72,000	0	0	Suspense accounts . . .	335	19	10
Preference shares—				Furniture, London office .	94	15	1
£5 per share on 6000 1st preference shares (7 per cent.)	30,000	0	0	Goods in transit	10	11	8
£5 per share on 1854 2nd preference shares (7½ per cent.)	9,270	0	0	Sundry debtors	6,883	1	10
£2 10s. per share on 100 2nd preference shares . . .	250	0	0	Bills receivable	2,160	0	0
£1 per share on 1429 2nd preference shares . . .	1,429	0	0	Stocks	15,149	16	0
Loans on debentures . . .	44,170	0	0	Cash	2,694	5	11
Sundry creditors	1,283	5	6				
Bills payable	756	11	4				
Interest & dividend account	3,346	1	1				
	£162,504	17	11		£162,504	17	11

Profit and Loss.

Coal	£6,104	17	3	Gas	£18,819	14	7
Gas-making (salaries and wages)	2,373	1	1	Coke	2,605	8	11
Charges on street lights . .	1,175	8	7	Tar	149	14	8
Wear and tear	1,146	11	6	Meters and fittings . . .	131	1	6
Purifying materials . . .	82	8	11	Transfer fees	2	15	0
Rents	52	8	5				
General trade charges . .	988	11	10				
Bad debts and allowances .	68	3	8				
Treasurer's commission at stations, and audit fee at Malta	289	13	0				
Preliminary expenses . .	193	0	2				
London expenses	1,142	15	8				
Law expenses	76	12	8				
Commission on shares . .	15	0	0				
Exchange	573	7	3				
Interest and discount . .	49	5	9				
Income-tax	27	19	5				
Balance to interest and dividend account	7,549	9	6				
	£21,708	14	8		£21,708	14	8

The CHAIRMAN: Gentlemen, in looking at the accounts now before us, a question of this kind is likely to occur to the mind of a proprietor, especially if he be acquainted with the affairs of English Gas Companies: "How is it that this company do not more largely share in the general and substantial prosperity which at the present time attends most of the gas undertakings in this country?" The answer is not difficult to give. That prosperity is, no doubt, the result of many favourable circumstances, but chief among them are good management and regular increase of business. Now, so far as success can be obtained from the first matter, we have no reason to complain. It is in respect to the second matter that we differ so entirely from other concerns. For the last three years the sale of gas has been practically the same. We are now selling about the same quantity which we sold in 1871, and less than we sold in 1872. The non-progressive character of the company's business is an effectual bar to improvement in any other respect. With a moderate increase of business we should acquire strength, and grow, so to speak, beyond the influence of difficulty. Without that increase we are unduly sensitive to adverse circumstances; hence the great desire of the directors to increase the company's business One thing may indeed be said—our constitution has been well tested and tried, and we are acquiring a discipline which will, no doubt, be useful to us in better times. I make these remarks because, with the exception of the improved dividend, the general aspect of the company's affairs is at the present time very much like what it was at our last meeting. In a few things we are somewhat better, and I think in no respect worse. The absence of increase in the company's operations is attributed to badness of trade, and as, in Southern Europe, the most rigid economy is the rule, the consumption of gas must decrease to a certain point. It is, however, thought that this point has been reached, and that a favourable reaction is taking place. If this be so, we shall soon experience the full advantage of the decreased expenditure in respect of coals and other matters, to which we owe the increased rate of dividend now recommended. With regard to the various stations of the company, I have but little to say. At all of them the works have been well maintained, and the working has been of the usual satisfactory character. Any slight retrogression at one place has been balanced by a slight improvement at another. Strange to say, the station which we have always looked upon as our worst station (Marsala) has shown the largest amount of improvement. Indeed, had the other stations shown the same rate of increase as Marsala, the general accounts would have been very satisfactory. In connexion with this station, I have, however, to state that the debt owing to the company from the Municipality is still unpaid. Matters move very slowly in Sicily. For a long time, payment depended upon some indefinite contingency, such as the general improvement of business. But negotiations for a loan from the Government have now been completed, and it is understood that the money will soon be in the possession of the Municipality, who have promised that the company's claim shall be one of the first to be satisfied. I take leave to briefly call your attention to some of the items in these accounts, especially in comparison with the accounts of the preceding year. And first as to capital. You will at once notice that during the year the second preference capital has been increased by the issue of shares to the extent of £2250. But you will also perceive that the liabilities on account of the items, loans on debentures, bills payable, and sundry creditors are £1750 less. On the other side, there has been a capital expenditure of £671, chiefly on account of new services and mains. Two items which were in last year's account do not appear in this—viz., "Preliminary expenses," and "Commissions on debentures." The first has been disposed of by charging it to profit and loss. The second has been carried to the "Suspense account," which is, notwithstanding, smaller than it appeared last year. In the accounts of last year there is an item which in this account is conspicuous by its absence—the reserve-fund. There do not appear to be any special directions with regard to a reserve-fund in the Articles of Association. But in the Act of Parliament by which we are controlled—the Companies Act of 1862—and in the 74th section of the first schedule of that Act we find the following direction:—"The directors may, before recommending any dividend, set aside out of the profits of the company such sum as they think proper, as a reserve-fund, to meet contingencies, or for equalizing dividends, or for repairing or maintaining the works connected with the business of the company, or any part thereof." The directors, having given the subject the consideration to which it is entitled, came to the conclusion that the time had come when this fund might be very properly applied to some of the purposes mentioned in the Act, and it was decided to charge against it the cost of (1) enlarging and repairing a gasholder at Malta; (2) erecting a complete boundary-fence, enclosing the company's property at Corfu; (3) a sum depreciating the stock of gas-fittings; (4) a sum towards meeting an exceptional loss on some dishonoured bills at Corfu. The loss will probably amount to £280, of which £83 has been charged to the reserve-fund, and the rest to profit and loss. Of course the whole of these matters might have been charged to profit and loss, and the reserve-fund taken for the purpose of dividends. The result would have been the same, except that the arrangement made has the merit of being more clear and straightforward as a matter of account. But I am sure the proprietors will agree with the directors as to the desirability of reconstructing this fund at the earliest possible opportunity. In the profit and loss account it will be seen that the gas-rental is slightly more, and the receipts for residuals and fittings slightly less than for last year. On the other side there has been an unavoidable increase in the working expenses, but coals were some £1100 cheaper, and this was found sufficient to cover all extra expenditure and short receipts, and to give the increased dividend recommended in the report. I am sorry to be obliged to make such an uninteresting statement, but I have simply to describe things as they are, and, after all, they might have been worse. As regards the future, things look brighter. The price of petroleum has gone up, to some extent permanently, and persons are again resuming the use of gas, especially of late. In Sicily a railway is in course of construction between Marsala and Trapani, which it is thought will benefit both places. At Corfu we have secured some extensions of lighting. At Malta there is every probability of occasional visits from the fleet, and the consequent influx of visitors from the country to the town. And it is said that the new opera house will be opened in October. Although these things cannot greatly affect the current year, I think we may reasonably look forward to easier and more profitable circumstances. I now beg leave to move that the report and accounts be received and adopted.

Mr. RHODES seconded the motion.

Mr. JONES said he regretted to find that, while there was no increase in the gas-rental, there was an increase in the expenditure during the year of £671. He would ask the chairman to explain to the meeting the very large item in the accounts of £15,149 for "stocks."

Mr. H. P. STEPHENSON said there was one point to which he desired to call the serious attention of the board. It would be in the remembrance of the shareholders that four or five years ago, before the chairman had a seat on the direction, the company were almost in a state of collapse, owing chiefly to the large amount of debenture debt hanging over them. At that time, he consulted with other shareholders, and there was the scheme devised of second preference shares, which it was hoped and believed would replace debenture capital, and it was then clearly understood that the debentures were to be reduced from time to time, as opportunity occurred. Now he thought it was one of the blots in this company—the only blot, barring the non-payment of a high dividend—the existence of this debenture debt. He desired to call attention to it in the most friendly spirit, but with the hope that another hammer on that anvil might cause notice to be drawn to it in a more prominent manner. It was not only that nothing had been done in the way of reducing that debt, but that there had been a very large increase made to the capital with a decreased rental. He had taken out the figures since 1870, and would read over the first and last years of that period. The shareholders would be surprised

at the large increase which, with a diminished rental, had been effected in the capital of the company. For the year ending March, 1870, the debenture debt stood at £33,400; bills payable and creditors, £5925; and at that time there was no "Second preference capital." For the year ending March, 1877, the debenture debt stood at £44,170, an increase of nearly £11,000; bills payable and creditors, £2049, a decrease of about £4000; but, instead of having no "Second preference," as in 1870, they had now £10,949, showing that between 1870 and 1877 the capital of the company had increased about £1700, without any corresponding increase in the rental at all, while the dividend had decreased from 5 per cent. to 2½ per cent. Of course, during the coal panic, they were not surprised at that. He remembered some years ago suggesting to the then board that which he believed was the cause—viz., that they were expending a large amount of money upon the Trapani and Marsala stations, which would never come to any good. Indeed, he told them that, in his opinion, they had better give those stations away than expend further capital on such unremunerative property. They did not, however, give them away, but said no one would have them at a gift, and now the fact stared them in the face that, with a diminished rental, they had an increased capital of £1700. This was a most unsatisfactory state of things, and he did not think the chairman could explain it. He (Mr. Stephenson) had the highest confidence in the board as at present constituted, and his observations had nothing in them of a personal character. He hoped that in the future a strict eye would be kept upon the capital expenditure.

The CHAIRMAN: Except in one respect, the questions asked by our friend, Mr. Jones, will be answered by my reply to Mr. Stephenson's remarks. That exception has reference to the value of the stocks. I have no doubt that the value of the stocks strikes Mr. Jones as exceedingly large when put by him in comparison with the operations of the company. But he will find it the case in all companies like this that the stocks run very high. They consist, first of all, of a very large amount of gas-fittings (which I wish were not so largely represented here), but their value has not been added to for a considerable time. There are also several other things which in our business we are obliged to keep in stock. The fact that we have five stations at considerable distances from here and from the head station at Malta makes a large stock necessary. I am glad the question has been asked, for it enables me to refer to one matter which I had forgotten. I ought to have stated that we have a very large stock of coal. Some time ago matters assumed so threatening an aspect in the Mediterranean that the directors deemed it advisable to make considerable purchases, a course which has been justified by subsequent events. With regard to the increase in the capital of the company, the views taken by the directors and by Mr. Stephenson are precisely the same; and since the present board have been responsible for the conduct of affairs, they have done all in their power to limit that increase. Three years ago we started on the very path that Mr. Stephenson suggests we should now take. There was a little increase a few years ago in settling up matters, and there was also a small increase in escaping from the heavy weight upon us arising out of the inelasticity of the company's business. We made some exertions to improve the business chiefly by extensions of mains, and the outlay upon these represents the principal portion of that increase. The shareholders may take it for granted that the most watchful care will be exercised in regard to the expenditure; and it is certain that if expenditure is incurred, it is because we cannot help it—it is unavoidable.

The motion was then put and carried.

The CHAIRMAN formally moved resolutions declaring the dividends recommended in the report.

Major SUART seconded the motions, which were put and carried unanimously.

On the motion of Mr. HODGSON JONES, seconded by Mr. STEPHENSON, the retiring director, Mr. Andrews, was re-elected.

Mr. ANDREWS, said he was obliged to the proprietors for the honour thus conferred upon him. His satisfaction would be much increased if, during his renewed term of office, the profits of the company's business enabled the directors to increase the rate of dividend.

The auditors were re-elected, their remuneration for the past year being fixed at 20 guineas each.

Mr. HERSEE returned thanks for himself and colleague, Mr. Daniell.

On the motion of Mr. STOKES, seconded by Mr. JONES, a cordial vote of thanks was given to the directors for their services.

The CHAIRMAN acknowledged the vote and the proceedings terminated.

CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of the Shareholders of this Company was held at the Office, Commercial Road, Pimlico, on Thursday, June 28—Mr. J. DEEDES, the Governor, in the chair.

The usual formal business having been transacted,

The SECRETARY (Mr. Albert Gill) read the report of the directors, which was as follows:—

The certified accounts of the company for the half year up to the 31st of March last are laid before the meeting, printed copies having been sent, as usual, to the proprietors.

The moneys received on account of capital in the financial year to the 31st of March last amounted to £64,350—viz., £63,880 from proprietors on account of the last issue of stock, and £450 from the sale of surplus land. The expenditure on the same account in the same period amounted to £74,775 7s.—viz., £64,813 5s. 11d. paid on account of the Molesey extensions, £1662 1s. 1d. on district extensions, and £8300 in redemption of bonds.

The total capital receipts, up to the date of the account, amounted to £1,113,280, and the total expenditure to £1,093,098 11s. 11d., leaving a balance of £20,181 1s. 1d. in favour of the account on the 31st of March.

The gross water-rental for the year amounted to £93,178 6s. 8d., and the charges for maintenance and management to £28,434 1s. 8d., and, after providing for all claims chargeable against the account for working expenses and dividends and interest accrued on the preference stocks to the 31st of March, there remained a sum of £48,685 5s. 10d. applicable to the payment of dividend on the ordinary stock of the company.

In the same year there have been laid for district extensions, 3137 yards of additional main and service pipes. Building operations, involving considerable alterations in the district, are being carried on in parts of Chelsea and Westminster; 177 houses have been pulled down, and 243 new houses have been laid on, leaving a net increase of 66 additional supplies.

The total quantity of water supplied to the district was 60 million gallons in excess of the quantity supplied in the preceding year, but the excess is fully accounted for by the increase in the quantity supplied by meter for trades.

The system of inspection of water-fittings continues to work satisfactorily, and has resulted in a large saving of waste.

The engineer reports that all the company's buildings and machinery are in thorough repair, and in excellent working order. By means of the pumping-engines erected at Molesey, which were set in motion in December last, the company, since that date, have been enabled to use water from the new intake, and the filter-beds have been worked satisfactorily since the water has been taken from the upper reach of the river.

Two of the storeage reservoirs are nearly finished, and will be filled and ready for use next month; the other two will, in all probability, be finished in September. It is expected that the whole of the works at Molesey will be completed and in use before the winter.

The Fire Brigade Committee in the House of Commons have finished taking evidence, having held 22 meetings last session, and 13 in the present session. Their report has not, as yet, been issued.

The directors recommend that a dividend at the rate of 6 per cent. per annum be now declared on the ordinary stock, and be paid on the 5th of July next.

The directors announce with sincere regret the loss the company have sustained by the death, on the 25th ult., of their colleague, Mr. Henry Hyde. It will have been observed, in the printed notice of this meeting, that the vacancy is to be filled up by the election of another director. It will also be observed that two auditors are to be elected in the room of William Henry Westwood, Esq., and Robert Webber Monro, Esq., who have resigned.

The GOVERNOR, in moving—"That the directors report be received and adopted, and entered on the minutes," said he would first take that opportunity of saying that his brethren in the direction and himself extremely regretted the loss which they had sustained in the death of their late colleague, Mr. Hyde, who had been for a long time an invalid, but when he was able to give his services to the board, they found them extremely efficient and valuable. He would now make a few remarks on the report which had been just read. The first paragraph related to the last issue of stock of £80,000, which was the remaining half of the £160,000 which they were authorized to raise by their last Act of Parliament. The sum of £80,000 had been previously collected, and of the remaining issue of £80,000 they had received £63,880, and the remaining portion of that £80,000 was the same which gentlemen had received notice they were to pay by the 30th of June. This second £80,000 would then be completed, and then there would be a sum of £40,000 to raise, the company having a limit altogether of £200,000—namely, £160,000 by shares or stock, and the other £40,000 would be raised subsequently, as it was wanted, by debenture bonds or loans. It was stated in the report that the gross rental for the year up to the 31st of March had amounted to £93,178, which was made up of £46,968, the rental up to September, 1876, and the remaining sum of £46,209, which appeared in the accounts before the meeting, was for the half year to March last. The charges of maintenance and management also for the year did not fully appear in the accounts before the meeting. For the half year to the 31st of March last, these charges absorbed £13,517, and the half year ending with September, 1876, accounted for £14,917, making the sum given in the report of £28,434 for the year. The next paragraph in the report was one which he hoped the meeting would think quite satisfactory. It showed the balance applicable to dividend on the ordinary stock to be £48,685—that was the balance brought from the last account of £1657, and £47,028 which had been added to it. Looking at the works going on, and the expenses of various kinds falling on the company, he thought that was a very handsome sum. Reference was made in the report to buildings and similar matters, and these were of an extensive character; and it was stated in the report that building operations, involving considerable alteration in the district, were being carried on in parts of Chelsea and Westminster. The houses were in what was to be called Hans Town or Hans Place, where a wide road was being made; also in Victoria Street and Queen Anne's Gate, where probably many might have seen houses which one would think were going to reach up to the skies. In Bridge Street and Parliament Street, Westminster, there were also extensive buildings going on. As to the waste inspection, that had been fully attended to since they last met, and it was only that very day that the last figures were brought in, showing the state of the matter. He had not the very latest, however, but he would give them those figures which had come in that day. The houses inspected to Lady-day last—inspected for the purpose of seeing whether the fittings were right and proper, or what alterations were required in them—were 23,000. Imperfect fittings were found in 12,227, and notices were served and complied with in 11,805 of these cases. This, he thought, showed that no improper intrusion was made into the houses and places of these persons, but was only carried out in a proper way. This left 422 out of the 12,227, and with these he thought a settlement would be come to on the employment of further pressure. The pumping engines at Molesey, as stated in the report, were set in motion in December, and he thought they had great reason to congratulate themselves that the new intake was completed when it was, because since then there had been exceedingly heavy floods; and had they not been in possession of their new track line, they might have had serious misfortunes falling on them, as occurred some time back. They felt, therefore, that great advantage had been derived from the new intake. With regard to the storeage reservoirs, it was stated in the report that two were nearly ready. One, he was happy to tell them, was completely filled on the 26th of the month, two days previously, and the second was in process of filling; and it was stated in the report that the four would be completed for the winter. They did not wish to claim any credit, but still they thought it right to mention that no time had been lost in this matter. The Royal Assent was given to their Bill in June, 1875, and the whole of the pipe track had been completed, and the four reservoirs were in active progress, one of them being quite completed. He did not know that there was anything further for him to say, except that a pamphlet had been received by him, as chairman of the Chelsea Water-Works Company, from Dr. Tidy, being the report submitted by that gentleman to the Society of Medical Officers of Health. There was only one paragraph with which he would trouble them. Dr. Tidy stated, after having gone through the different companies, as follows: "Lastly, I am of opinion that my analyses prove that London enjoys a water supply of very considerable purity, and I am further convinced that, from a medical point of view, no substantial objection can be urged against its wholesomeness for dietetic and culinary purposes." He thought it was only right for him to mention this. He concluded by moving the resolution.

Major BOILEAU, in seconding the resolution, said he considered the report was very satisfactory, and the accounts were likewise in a most promising condition. The simple fact of there being £1657 increase applicable for dividend for the half year was in itself quite argument sufficient to show that they were prosperous and moving forward. What the chairman had stated as to the increase of buildings in Hans Place was also a material point for consideration. The condition of the new reservoirs at West Molesey he regarded as most satisfactory. It was particularly so, because they were told that these reservoirs would be completed before September, before the autumn and winter, and before the discoloration of water took place consequent on that season of the year. It was most satisfactory to know that the reservoirs would be completed before that period of the year, and that the water would be so far cleaned through the subsidence that they might hope that during the winter, though it was an unfavourable time for water companies during that part of the year, that the Chelsea water would be bright and clear, and that they might have no complaints, as they had some two years ago, before these reservoirs were undertaken. As to the accounts, he was sure that they might accept what the chairman had said about them. He seconded the resolution with great pleasure.

The motion was at once carried unanimously, as was also a further resolution, on the motion of the GOVERNOR, to the effect—"That the accounts, as laid before the meeting, be received and entered on the records."

The GOVERNOR then moved, and Major BOILEAU seconded, the following resolutions, both of which were carried unanimously—"That the directors be, and they are hereby, authorized, to set apart and pay so much money, on the 5th day of July next, as will be sufficient to discharge the dividends which will become payable on that day on the preference stocks," and—"That a dividend for the half year, at the rate of 6 per cent. per annum, on the ordinary capital stock, be now declared and paid on the 5th

day of July next, to the several persons and corporations who are proprietors of such capital stock."

A SHAREHOLDER moved the re-election of Mr. Deedes as a director. He need say nothing in favour of Mr. Deedes's qualifications, as the prosperity of the company was ample evidence of this.

Major BOILEAU said every gentleman present would have been glad to second the motion, and it gave him very great satisfaction to do so.

The resolution was carried unanimously, and, subsequently, the Rev. Edward Moore (the deputy-governor) and Mr. W. H. Child, were also re-elected directors.

The GOVERNOR, in returning thanks for their re-election, said he and his friends at least endeavoured to do their duty, and they were very much obliged for the confidence reposed in them. He then announced that a director had to be elected in the room of the late Mr. Henry Hyde. Three gentlemen had signified their wish to be elected to the vacant seat—Mr. Robert Webber Monro, Major Montagu Barton, and Mr. John Stone Wigg. If these gentlemen were proposed, he should put their names respectively in the order in which he had mentioned them.

Mr. HALLETT moved, and the Rev. G. A. LANGDALE seconded, the election of Mr. Monro, whose various qualifications for the vacant seat they enumerated.

Mr. WIGG said that he had heard that Mr. Monro was an important candidate on that occasion, and he himself was late in the field. He should therefore support Mr. Munro's candidature, and withdraw his own name. He mentioned that his father was a director of the company for many years, and that if he had an opportunity on some future occasion, he should be prepared to lay his claims before the proprietors.

Mr. COBBS, on behalf of Major Barton, withdrew that gentleman's name from the list of candidates for the vacant seat at the board.

Mr. MUNRO was elected a director, and, in returning thanks, said he hoped that, so long as he had a seat at the board, the proprietors would never have occasion to regret the confidence which they had placed in him.

The GOVERNOR stated that two auditors were to be elected in the room of Mr. William Henry Westwood and Mr. R. W. Monro, resigned. Four gentlemen had addressed the proprietors, signifying their wish to become auditors in the room of the retiring auditors—Mr. Borlase Hill Adams, Mr. George Fen Aston, Mr. George Davison Gibbes, and Mr. William Donaldson Rawlins.

These gentlemen having been proposed and seconded in the order given,

The GOVERNOR took a show of hands in each case, with the following result:—For Mr. Adams 24, for Mr. Aston 22, for Mr. Gibbs 4, and for Mr. Rawlins 8. The show of hands, therefore, as announced by the governor, was in favour of the first two gentlemen; but a poll was demanded, which it was proposed to take immediately, the meeting standing adjourned till Monday for the declaration of the result.

In reply to a cordial vote of thanks to the governor and the other directors,

The GOVERNOR said without his colleagues assistance he should be *nil*, or almost so. They had all to thank the proprietors for the confidence reposed in them.

The proceedings then terminated.

Yesterday the Adjourned Meeting was held—Mr. JOHN DEEDES in the chair, to receive the result of the poll, and complete the election of auditors.

The SECRETARY read the minutes of the last meeting, which were approved. He then read the report of the scrutineers, Messrs. G. Gill and W. H. Turner, which stated that the result of the poll was as follows:—Mr. G. F. Aston, 3952 votes; Mr. B. H. Adams, 2961 votes; Mr. G. D. Gibbes, 1177 votes; Mr. W. D. Rawlins, 1061 votes.

The GOVERNOR then declared that Mr. Aston and Mr. Adams were elected auditors.

Mr. ASTON having briefly returned thanks for the honour conferred on him,

Mr. ADAMS said he could only echo Mr. Aston's sentiments. It was very gratifying to see the state of the poll. He would endeavour to perform his duty to the best of his ability, and would do his utmost to promote the interests of the company.

Mr. GIBBES said he did not know that it was necessary for an unsuccessful candidate to say anything, but he should like to thank those friends who had supported his candidature. He had been fairly and honourably beaten; he acknowledged this, and his only regret was that he had not taken the show of hands at the former meeting rather as an indication of the real state of affairs.

The meeting then separated.

ABANDONMENT OF THE EXETER GAS-WORKS PURCHASE.

At a Meeting of the Exeter Town Council, on Wednesday, June 27—Alderman CLIFFORD in the chair,

The Special Gas Committee presented the following report:—

Your committee were appointed on the 24th of February last, on which day the town-clerk, in accordance with instructions given him by the council, apprised the company by letter of the fact, and suggested a conference. The letter was acknowledged by the secretary, who promised that it should receive the attention of the directors. Nothing further was heard from the company until the 25th of April, when a letter of the previous day's date was received from the secretary, to the effect that the directors could anticipate no practical result from a conference unless the basis of the negotiations was first settled, and the committee were referred for the details of this basis, upon which alone it was stated the company would treat, to a previous letter from their secretary, dated the 31st of December, 1875.

The matter was accordingly considered both by your committee and by the council, who determined, and the company were so informed, that the conference would be held upon the understanding that if the council should decide to purchase they would do so on the terms expressed in that letter—viz., that the shareholders should be paid a guaranteed dividend of 10 per cent. upon their original capital of £40,000, in addition to the interest upon the preference capital and debentures, the latter to be paid off in full by the council as they come to maturity, or be renewed upon such terms as may be mutually agreed upon; and the 5th of June was fixed for the conference.

It being the object of your committee to learn whether the undertaking was worth the price the company thus placed upon it, they carefully prepared certain questions to put to the directors, and in particular they decided that they ought to be furnished with a revenue account—a detailed account of capital and expenditure—an account of the quantities of gas made and sold during the past year, a profit and loss account for the same period, and that information should be furnished to them as to the dividend paid by the company during a series of years, the average price of coal, the directors salaries and fees, the state of the reserve-fund at different periods, and as to the progressive growth of the business; lastly, that they should be made acquainted with the extent and probable cost of the alterations and improvements now being effected in the company's works, and to what extent such alterations and improvements had been completed.

The conference accordingly took place at the company's offices on the 5th of June, as arranged, when your committee were most courteously received by the chairman and other directors of the company, who listened to and took a note of the inquiries made by the committee, which they promised should be considered in due course by the board. The chairman then informed the committee that the present contracts for alterations and improvements amount to between £4000 and £5000, towards paying for which they were about to issue the remaining £1600 of their authorized debentures (thus making the total debenture debt £7500, bearing an average rate of interest of £4 6s. 8d. per cent., and bringing the total capital of the company up to £75,900, and that the balance of the cost would have to be provided for by the purchasers. He further stated that in addition to works now under contract it was essential that the company should immediately extend their retort-house, and that the cost of this too must be borne by the purchasers; and in reply to the inquiry as to the reserve-fund, he explained that it was made up of three items which at Midsummer, 1877, together amounted to £9409 19s. 5d., and that this sum, subject only to the payment thereout of the cost of current repairs since that date, would be divided by the shareholders in the nature of a bonus.

Your committee then withdrew to await the promised reply to their inquiries. That reply has come to hand, and is presented herewith. The company say that "they consider the questions as simply tending to a re-opening of the terms of the proposed sale and value of their works." They must have little faith in the agreed value if they (the directors) fear to afford information by which it may be tested; no doubt the questions were designed to test the value, but certainly they did not "tend to a re-opening of the terms of the proposed sale," those terms being in effect, "we will purchase the works at the price you name if on inquiry they appear to us to be worth it."

Your committee much regret the attitude which the company has thought fit to assume towards this council, and cannot but think it a very great mistake. They hope, however, that the negotiation, which has been entered into by the committee in perfect good faith, is not to be broken off in this highly unsatisfactory manner, and that the effort which your committee ask that you will authorize them to make to obtain information from the company, or some, at least, of the more important of their inquiries, may yet have a successful result.

The reply of the gas company referred to in the above report was as follows:—

Dear Sir,—My directors, having considered the questions addressed to them by the committee of the Town Council, beg to refer the committee to my letter of the 24th of April, and the reply of the town-clerk of the 10th of May.

My directors consider the questions as simply tending to a re-opening of the terms of the proposed sale and value of their works, to which they cannot consent.

My directors consider the only questions for consideration are the time and mode of transfer, the mode of securing to the shareholders the dividends mentioned in my letter of the 24th of April, and the payment to the company of the reserve and the contingency funds, and balance remaining at profit and loss account, and the propriety of an application to Parliament for carrying any arrangement between the parties into effect.

(Signed) W. A. PADFIELD, Secretary.

On the motion for the adoption of the report,

Alderman FOLLETT moved as an amendment—"That in view of other inventions for the supply of light, it is unadvisable to continue any negotiations for the purchase of the property of the gas company." It was with great reluctance that he gave notice of the motion, because he felt it might, to a great extent, render nugatory the efforts and exertions made by the various committees of the council, and might seem to stultify the deliberate vote of the council of the 9th of May last. He could not, however, but remember that the further action of the council would be of much importance, as the purchase of the gas-works would involve a large expenditure, taking the shape of an annuity in perpetuity. The question was whether the acquisition of the works would be a benefit to the city in perpetuity. He felt that this was a matter in which any labour of the council in the past should not be allowed to weigh against that which was for the public interest. It might be asked whether, after their vote of the 9th of May, it would not be a breach of faith to withdraw from the negotiations; but, having carefully considered the matter, he did not think there would be any breach, and it appeared to him that, as the committee were merely instructed to report, it was open to the council, before any definite conclusion was arrived at, to withdraw if they thought fit, just as the company might, if they thought it desirable, have also withdrawn from the negotiations. He felt quite satisfied the council could at this moment withdraw without any breach of honour or good faith. He had always had misgivings as to the desirability of the purchase of gas-works by public authorities, for he felt that public money should not be spent on anything that was not perfectly certain to be a perpetual benefit. He confessed, however, that when the question of negotiating with the company came before the council he voted for it, for at the moment they were all at their wits ends to know what they should do. What with the effluvium that came from the works, and the memorialists urging the council to take some steps to stop it, the council were in a perfect hornet's nest, and he then thought that, by taking the works into their own hands, the council might put a stop to the immediate evil, and that gas, as a means of lighting, would have a sufficiently lengthy existence to enable the council, by careful management, to recover the money spent in the purchase. However, before a week had expired after the ratification of the council's vote, he saw in the newspapers and the pamphlets accounts of the immense success of the electric light. When he read these reports, the misgivings he had, and the reasons he previously felt against the advisability of the purchase of gas-works, returned with renewed vigour. Only one small improvement was required to make the electric light entirely successful, and, at all events, applicable to public places and public halls, and possibly to private houses. He did not, however, pin his resolution upon that invention only. He had little doubt, however, that electricity was to be the power of the future. He believed that the full advantages electricity would confer had not yet been conceived by the mind of man. As he had said, however, he did not base his motion simply upon this invention, but he took his stand on the general ground that artificial light was a human invention, and, like other inventions, it was certain to progress, and to advance with the progress of science. A glance at the inventions of the last 50 years would fully confirm this. It was quite certain that a discovery such as the electric light would sooner or later be brought practically within the use of man. He could not for a moment believe that, whilst other inventions and discoveries progressed, light was to be an exception. As the lucifer match had superseded the flint, and the railway the stage-coach, so he was sure some better mode of giving light would be discovered, and the manufacture of gas would be set aside. Buying these gas-works would be very much like purchasing some broken-down stage-coach business, and therefore he asked the council to pause before carrying further their negotiations. He did not wish to be misunderstood. He did wish it to be supposed that no works supplying a commodity for public use should not be acquired by a public body. He thought that, for instance, it was most desirable to acquire the control of the water. Water, however, was not an invention; it was a gift of nature, and if discoveries progressed for a thousand years, he did not suppose there would be found anything that would supersede water. It would therefore be his desire, if a fair opportunity offered, to purchase the water-works. In passing, he might be allowed to state that the committee appointed by the citizens at their indignation meeting on the water question last autumn had not been idle, but he hoped that very soon they would come before the council with a tangible proposal. Returning to the gas, he was quite prepared, on general grounds, to propose the motion on the *agenda* paper, but the report they had heard read of what were called "the negotiations" of the committee with the gas company was a most valuable ally to him. It would have been impossible for the directors of the gas company to have attempted to deal with the council in a more high-handed manner, or in a manner more unlike negotiation. What did they ask the council to do? They asked the council to take their works, to give them the maximum dividend, to do nearly all the repairs, to be allowed to keep and divide among themselves a certain reserve which unquestionably ought to have been laid out in maintaining the works so that they could earn the maximum dividend, and then the directors passed on to say, "We'll have nothing more to do with you—only name your time and place of settlement." Was it possible to carry on negotiations with such men? After what they had heard he asked them to discontinue the negotiations with the gas company. He asked them to do so, in the first place, because

gas was a precarious and ephemeral invention, and because public money should not be laid out in that which was not perpetual, and which had only a precarious existence. Then gas, being a human invention, must pass away, and, from existing events, it was clear it would not have a very lengthy existence. In the next place, he felt certain that the payment to the gas company of the maximum rate of dividend could not possibly be repaid to the city during the time gas would continue to be the mode of general lighting. In the fourth place, he asked them to carry his amendment because, from the report before them that day, it was clearly impossible to carry on any practical negotiations with the company. He had not taken any pains to discover how his proposal would be received, and was not sure he should have a seconder. He wished his proposal to stand entirely on its own merits. If it was carried it would be necessary to determine, after careful consideration, what step should be taken in lieu of it. Some step, strong and forcible, must immediately be taken, and he should be prepared, at the proper time—before the expiration of the date of termination of the statutory notice, July 16—to bring a motion before them. He now asked them to break off negotiations with the company.

Mr. HIRTZEL seconded the amendment, and said for many reasons he had been anxious that the council should acquire possession of the gas-works. The nuisance, of which the directors were, he believed, wittingly the agents, had existed so long, and so greatly decreased the value of property in the neighbourhood, that he felt for a long time that the only thing they could do was to get possession of the works themselves. But the reasons which Mr. Follett had adduced, and which had only recently come before them, had led him to change his opinion on the subject, and he knew, too, it was extensively felt out of doors that it would be unwise, under present circumstances, to spend the money of the city in the purchase of these works. He had fully considered the matter, and he was quite convinced that they would be wrong if they continued these negotiations. The extraordinary manner in which the directors had met the council was an additional reason why they should pause. Would any one go into a business without counting the cost? Would any private individual purchase a tradesman's business without ascertaining the state of his books, the amount of his capital, and whether or not the affair was profitable? Would any one propose to continue to pay a given amount as dividend without ascertaining whether it had been paid out of capital or revenue, and whether, after the necessary expenditure, he could hope to continue to pay such a dividend in future? Would any private individual allow to be divided, as a bonus among the people, selling capital put by for a rainy day, and still pay the same price for the article he was going to buy? He only knew one business bought on such terms, and that was the great house of Overend and Gurney, and the transaction brought misery to thousands. That business was bought at an enormous premium, because people thought it was a magnificent paying thing, and it turned out afterwards that if it had proceeded in its old course, it must have in a few months come to where it eventually did—the Bankruptcy Court. He thought the council would be very wrong if they did not pause and discontinue these negotiations.

Mr. F. THOMAS had always been against the purchase of the works. He thought they might safely carry this amendment in the interests of the gas company as well as the citizens. The present assumed discoveries of science could not but damage the company as a selling concern, whilst if they waited they might see the new discovery turn out a failure, and then the gas-works would be more valuable than ever, and the council would have done them great service in stopping the negotiations.

Mr. RICHARDS said he hoped at last the council would show that they knew their own minds about this matter, and decide what course they ought to pursue. Hitherto they had not acted towards the company in a dignified manner. If it was to the interest of the city that it should acquire the gas-works, no sentiment should be allowed to stand in the way. They had heard about the invention, it only wanted one link to make it perfect. It was always the case with these inventions—just one link was wanted. He had no faith in electric light superseding gas. He did not care a single straw about these inventions, he had no faith in them. The question was, was it advisable for the city of Exeter to make the gas of which it was the principal consumer? If it was not desirable, then let them stop the negotiations. As to the value of the property, naturally the company would not go fully into their affairs when there was so much doubt as to whether or not the council really intended to purchase. This uncertainty must influence the minds of the directors in their disclosures. He thought the council had to thank themselves for the position which the directors had taken.

Mr. WILLEY said he had studied the matter for 20 years, and noticing the improvements made in the production of gas, he had no fear of its being superseded by electricity. If it did, he should be one of those who would have to sing like the cotton spinners: "We have no work to do." The electric light had attained some success, but its pallid hue and the effect it had on the human eye were so objectionable that he believed it would never supersede gas. As to the proposals of the gas company, he thought them fair and equitable, and he believed it would be to the best interest of the city to entertain them. The council might, if they purchased the works, reduce the price of gas, pay annuities equal to maximum dividends, and still have over a surplus, which they could apply to the redemption of the canal, making Exeter a free port. If the council broke off the negotiations now, they would have to renew them again in a few years time, and would then be obliged to pay £40,000 or £50,000 more for the works than the sum now asked.

Mr. PEARSE said it would appear, from some of the observations made, as though they were now called upon to vote for or against the purchase of the gas-works. But the committee did not make any recommendation of the kind; they simply suggested that the negotiations should be continued, so that if terms were obtained advantageous to the city, the proposal might be made. No doubt some had been converted, by the eloquence of the mover, to a belief in the electric light, and others would support the amendment, not because they believed that the electric light would so supersede gas as to be useful in private houses, but because they would be glad of any excuse to prevent the council spending money on any improvement. If the electric light was found to be successful in some parts of England, Exeter would depart from its old tradition of being 50 years behind if it showed any disposition to readily adopt the new invention.

Mr. WILKINSON said the fact that the company required the council to take over works without knowing what those works were, and pay 10 per cent. in perpetuity without knowing what property they would have to earn the dividend with, seemed to him quite a sufficient ground for their declining to proceed any further with the negotiations. It was unjust, unfair, and impolitic for the company to ask them to conclude a bargain on such terms.

Mr. LLOYD said the basis upon which the directors asked them to proceed was the basis which had been accepted and acted upon by many of the principal cities in England. In Birmingham notably it was the case. Personally he had for many years thought it would be advisable for the council to possess the gas-works, and he was satisfied that with a different administration they could be made a profitable concern, paying the dividend guaranteed, and even selling gas of a better quality at a lower price than that which was now paid. He was exceedingly sorry the affair had drifted into its present position, but he hoped the council would reject the amendment, and empower the committee to continue their consultation with the directors with the view of arriving at a businesslike arrangement.

Mr. JONES counselled the continuance of negotiations which might lead to the offer of better terms.

Mr. FORCE supported the recommendation of the committee that they should have power to carry on further negotiations, because he believed that, in the end, they would be more thoroughly convinced that they ought not to purchase the works.

Alderman BUCKINGHAM said he had heard nothing that would induce him to vote for the purchase. He objected to the terms offered by the company, because the directors were taking their present rate of dividend, 10 per cent., admittedly obtained by a somewhat precarious business, and were asking the council to make it a permanent and perpetual payment. Now, any one knew the difference in value of a per centage obtained from a precarious business, and one obtained from an undoubted permanency—such as the security of the rates of the city. Ten per cent. secured by the city rates was of double the value of 10 per cent. from the precarious business of the gas-works. The council were asked to convert that doubtful per centage into a permanent one at the expense of the city. He could not vote for such terms. They were not reasonable. It was no answer to his objection to say that Birmingham and some other places had purchased their gas-works on those terms. Those other places were, perhaps, in the midst of a coal district, and probably the works were in a far better condition. Admittedly the gas-works of Exeter were not of the soundest character, and there would have to be a considerable outlay to put them in the condition they should be. The company, however, were asking the council to give for what was a rotten, unsound, unsuitable, and old process, the utmost figure they could have asked for a concern of the newest and soundest description. If terms were offered consistent with the condition of the works, he did not say the council might not have entertained them, but when the proposal to negotiate was made, they certainly had not any idea that the terms asked would be such as were now before them. Besides that, things had transpired within the last twelve months which might very reasonably lead the members of the council to alter their minds. The company seemed determined to go on in their old way, and they had no right now to complain because the council would not adopt that which, in their ignorance of something better, they might have adopted. He believed that modern science would produce a light that would be a substitute for gas, at least in streets and public buildings, and the council had mainly to do with lighting of that character. That being so, it would not be wise for Exeter to saddle itself with a great expense, and then remain altogether blind to the advance of science, and leave the city comparatively in the dark as compared with other places. If they purchased the gas-works, and the electric light was perfected, the city would have a double expense—the burden of the debt of the gas-works and the expense of establishing and maintaining the electric light. He should therefore support the amendment.

Mr. NORRINGTON, as a matter of safety, supported the amendment to abandon all further negotiations with the company. On the terms offered the purchase would cost £170,000 or £180,000. They would be simply purchasing a monopoly, and it was a question whether it was worth so large a sum as that to which he had alluded. The advantages of having the works would be the provision of purer and better light, the avoidance of the stench which had been so great a nuisance to the city, and the ability to sell gas at a cheaper rate than it was sold at present. But they were not obliged to purchase the works to gain those advantages.

Mr. FOLLETT having replied, the question was put, and on a division the amendment was carried, the numbers being—For, 22; against, 8—majority, 14.

WORKING GAS-RETORTS BY MECHANICAL MEANS.

By Mr. CHARLES C. MOWTON, Engineer to the New York Gaslight Company.

[A Paper read before the Society of Local Gas Engineers, at New York, on June 2, 1877.]

Of the various problems which continually present themselves to the attention of the engineer who is interested in improving the known, and developing the unknown, means of more economically producing illuminating gas by the distillation of coal, none appear to be surrounded with more difficulties, or require more patient research for the discovery of "means to accomplish ends," than that of substituting steam power or its equivalent for manual labour in the working of the retorts.

The subject is no new one to the minds of the gas fraternity, its successful accomplishment being a boon long sought for, and believed by them to be, when practically demonstrated and introduced to general use, the desired panacea which will ameliorate, in a measure, the evils incident to the practice now in vogue, and which entail upon the gas company the expense, and upon the engineer the management of large numbers of men, who, in times of an unsettled labour market, have it in their power to cause considerable trouble.

Various methods have been devised for the accomplishment of the object in question, and many engineers of England and the Continent have applied their best energies to the study of the subject, and while several ingenious and apparently feasible machines have been devised in that quarter, none of the productions seem as yet to have commanded public attention, or have produced the results in actual practice which are necessary to ensure their taking rank as necessary and permanent adjuncts to the plant of retort-houses.

The conditions which it would seem should obtain in any mechanism for the purpose under consideration are of a threefold character—that is to say, there should not only be the ability to put the coal into the retort, and to withdraw the coke (the two functions which as yet are those only which have attracted the attention of engineers upon the other side of the Atlantic), but there should exist the ability to separate the coal into given quantities, at the will of the operator of the mechanism, so that a retort may be charged with a specified weight, and its neighbour with a greater or less amount, as circumstances may require. It is of the utmost importance that the coal should be evenly laid upon the floor of the retort, ensuring thereby an even penetration of heat to the mass.

At the present time, there is a power retort-stoker, operating ten benches of six retorts each, at the works of the New York Gaslight Company. It is the invention of, and constructed by, Mr. Thos. F. Rowland, of New York, and is daily proving its ability to perform the labour for which it was intended, much better and more economically than the same can be manually accomplished.

It is capable of being, and often is, worked at the rate of drawing and charging 20 retorts in as many minutes, cleaning them perfectly, and depositing the coal evenly therein. Its ability to automatically divide the coal into equal or unequal quantities at the will of the operator is remarkable, and of such precise character, that, when set for a given quantity of coal per retort, and the receptacle of the apparatus loaded with the aggregate coal for, say, 20 retorts, the receptacle will be emptied when the last retort is charged, and each individual retort will have

received its proper quota, and this without any attention from the operator whatever. The ability to unequally divide the charges is such that one retort may receive, say, 300 lbs. of coal, and the next one 150 lbs., or any number of pounds intermediate to the two sums, by simply turning an index wheel, which can be accomplished in 20 seconds.

The apparatus is so designed that it will command the retorts, regardless of any irregularity in the system of the setting, although it is preferable that they should be equally spaced, to ensure the rapid working of the machine.

The apparatus is briefly a locomoting carriage, travelling, by preference, upon an elevated rail, although it would be equally as effective on a surface rail, the former being adopted in order to keep a clear floor space for the coke buggies, in the case of the New York works.

Its functions are to travel the length of the retort-house, automatically divide the coal into specified quantities, putting the same into the retorts, and delivering the coke into the waggons.

The scheme also contemplates the automatic receiving of the coal from the store-house, sizing it to cubes not exceeding a given dimension, weighing it in bulk, and depositing it into the hopper or receptacle of the charging-machine, without delaying the work of the machine, but this latter portion of the invention has not been introduced at the New York works.

The power to perform the various functions is conveyed by means of compressed air, which has proved itself a valuable agent, as it performs the triple duty of functioning the machine, creating ventilation by the exhaust, and tending to keep the operator cool; and last, though not least, affording a means of preventing the rake and handle of the drawing portions of the apparatus from becoming hot and melting, which end is obtained by causing the air to pass through the handle and hoe, thus carrying off the heat, and obviating what at first threatened to be a serious drawback to success—*i.e.*, the constant and rapid destruction of the rake or hoe, and the handle to which it is attached. As an illustration of the value of this device to prevent the rake and its handle from heating, it is well to state that, previous to its adoption, those portions would be burnt out about every day, whereas the machine with the air circulating through the rake has run for four or five weeks, and as yet there is no sensible depreciation in the strength, or change in shape, of the parts which come in contact with incandescent coke.

Regarding the question of economy, it is but fair to state that the machine as now being run is not a true exponent of its value. The scheme being new, and consequently undeveloped, it was considered expedient to test it as to its power to perform the functions claimed for it, and also to settle the question of wear and tear, rather than to put it upon its economical test before the other factors were ascertained.

It was thought that this object could be attained by working it upon ten benches of sixes (60 retorts), notwithstanding its capacity is equal to two and a half times that number, and working upon which it would develop the most economical duty.

The test as made—*i.e.*, working ten benches of sixes, which it has now been doing for something over four months, drawing and charging in that time about 5000 retorts, has proved its ability to do all that its founder anticipated, while the wear and tear of the machine proper has been much less than its most sanguine advocate had believed and stated would result. From the data now obtained, it is believed by those competent to judge, that the subject of wear and tear in machines of the character of the one in question has been over-rated, and that when they become a permanent institution in our retort-houses, it will be found that the expense incurred in keeping the apparatus up to its proper standard will not exceed that now expended in repairing the scoops, shovels, rakes, &c., incident to the present method of operating.

The inventor states that the apparatus is capable of saving from 30 to 40 per cent. of the wages expended in a retort-house manufacturing over a million cubic feet of gas per day, and that a further advantage obtains by reason of a greater yield of gas from the coal (which he says is from 6 to 8 per cent. of the entire quantity), primarily consequent upon the evenness with which the coal is deposited upon the floor of the retort, and secondarily from the rapidity of the charges and the regularity of their capacity. These points remain to be proved; but it is patent, from the experience obtained at the works of the New York Gas Company, that a gain of at least 25 per cent. over the old method of working may be effected by substituting machinery of the character in question, and working the same at its economic capacity. Mr. Rowland has designed his inventions with reference to their adoption by the gas companies of the larger cities of England and the Continent; and, in response to invitations from gentlemen of London, interested in the subject, he has executed a set of drawings, showing the machinery as he would propose to construct it for works of the magnitude of those at Beckton.* In this case he proposes to make the drawing independent of the charging apparatus, each function being performed by a separate machine, having its own engine, and capable of locomoting distinct from the others. Experience has demonstrated that the function of charging can be performed in one-third the time required for withdrawing the coke; he, therefore, proposed to supply the drawing machine with three sets of raking gear, each set under the control of an operator.

The machine travelling along the house will be drawing three retorts at once, or at the rate, say, of 90 or 100 retorts per hour. While the charger following after, will divide the coal, and charge the retorts with equal facility, under the guidance of an operator. Thus two sets of this machinery, one on each side of the range of benches, will work the entire house, or, say, 600 retorts.

Mr. Rowland says the number of men required for the whole operation—that is to say, from the time the coal is started on its travel from the coal store (which in the case of the Beckton retort-house consists of wings adjoining or forming part of the houses, and are parallel to the benches)—until it arrives as coke, and is deposited in the waggon beneath the stage, will not exceed 50 (per 24 hours working of the house), or an average of, say, one man to every 40,000 feet of gas produced, assuming the house to be capable of producing, when worked at its full capacity, 3 million cubic feet of gas, and that two-thirds that amount is its fair average daily production.

Of course, the opinions herein stated are more or less based upon theoretical deductions, and time will necessarily elapse before the predicted results give place to ascertained facts.

It is the intention of Mr. Rowland to pursue the subject until he has exhausted it, and demonstrated, both here and abroad, that all obstacles to the permanent substitution of steam power, or its equivalent, for manual labour in working retorts are removed, and that the transition has become an accomplished fact; or otherwise prove the obstacles to be insurmountable, or that he, at least, is unable to master the subject.

* Engravings from these drawings are in course of preparation for publication in the JOURNAL.—ED J. G. L.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There has been a decidedly quiet feeling during the week, notwithstanding the slightly higher prices commanded by Scotch makers brands, and some of the smelters of the district have been selling parcels of pig iron at something like 1s. to 1s. 6d. per ton under the quotations of ten days or a fortnight ago. In all branches of the iron trade, in fact, matters remain very quiet, and there is a tendency in many quarters to effect a further reduction of production. Many of the blast furnaces in this district are out of blast, and there is not the slightest prospect of their being relighted for several months henceforward. This is particularly the case in the Sheffield and Rotherham districts, at and near Leeds, and in North Lincolnshire. In Derbyshire as well, a considerable proportion of the furnaces are idle, even at such first-class concerns as Staveley, Clay Cross, Sheepbridge, &c., although those establishments are much better employed, on the average, than any other places in the same county, with the exception of Butterley. In South Yorkshire both the Thorncliffe furnaces are going, Messrs. Newton, Chambers, and Co. having some good orders on hand. They have also just secured a contract from the Leeds Corporation for most of the iron and special work required for the new extensions at the York Road depôt.

As I have stated several times of late, all the merchant iron manufacturers are very indifferently engaged, although at some of these works there is still a fairly good inquiry for common bars, plates, and sheets—all of which, however, are being "done" at exceedingly bare prices, owing to the excessively keen competition.

In the coal trade there has been rather more business doing during the week on shipping account, last week's foreign shipments alone from Grimsby, Hull, and Goole having exceeded 25,000 tons, of which the lion's share, as usual, went from Hull. House coal is at a discount, so that many of the collieries which chiefly rely upon its sale are doing next to nothing. In the Dronfield district, in fact, all the pits, with but one exception, are now laid off until such time as trade shall improve, or the men accept heavy reductions of wages.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There are now indications of the approaching collapse of the miners strike in West Lancashire. In the Haydock district large numbers of the non-union men are returning to work at the reduced rate of wages, and although in the Wigan and St. Helen's districts the colliers still hold out, it is scarcely probable that the non-unionists, who are receiving little or no support, will be able to continue the struggle much longer.

So far as trade is concerned, it is generally quiet, and in gas coals there does not appear to have been very much doing during the last week or two. For all classes of round coal there is only a limited demand, and supplies, notwithstanding the stoppage of the pits, are quite sufficient to meet all the present requirements of consumers, who have no difficulty in placing their orders at late rates, good Arley coal at the pit mouth being offered at 10s. to 10s. 6d. per ton, and Pemberton four-feet at about 8s. 6d. per ton. Common coals are not so plentiful in the market as they were before the strike, and the pits that are working are fairly employed, with prices ranging from 6s. 6d. to 7s. 6d. per ton at the pit. Engine classes of fuel are very scarce, and prices are stiffer. Good classes of burgy sell freely at from 5s. 3d. to 5s. 9d. per ton. Consumers of slack find it difficult to obtain their full supplies, and advances, ranging from 6d. to 1s. per ton, are being obtained from new customers, good qualities at the pit mouth being, in some cases, quoted at 5s. 6d. per ton, and the average rates at 4s. 6d. to 5s. per ton.

The shipping trade continues very dull, and there will be little or no improvement until after the close of the strike.

The iron trade is still in a very depressed condition. Local makers of pig iron are doing very little, and although holders of north country brands are pushing here at extremely low prices, they are securing very few orders, consumers evidently neither wanting nor caring to buy iron at present. The finished iron trade is also in a similar condition, many of the forges have to be repeatedly stopped for the want of orders. Founders are doing nothing like their ordinary amount of business, and amongst engineers it is many years since there was such a general slackness. Prices are nominally without change, but there is such cutting and competition in various directions, that business of a remunerative character is difficult to secure.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

As predicted, Newcastle races interrupted all sorts of business last week. Very little was done, as Tuesday, Wednesday, and Thursday were kept as holidays on the Quayside. The gas coal trade is dull. For the past few months a good deal of gas coal has been sent to France, but trade is now nearly stopped for the principal ports, as the stocks are heavy. The same sort of quiet trade characterizes business with the principal coasting ports of England. Best gas coals are selling at 8s. 6d.; seconds, from 6s. 6d. to 7s. Though there have not been many orders in the market, gas coals are required every week to keep contracts running, and the shipments from the Tyne Dock have wrought up to about an average. Singular as it may appear, yet it is the fact, some, at least, of the Durham gas and household collieries are putting out more coals over the month than they did in prosperous times. Men are keener of work, and the establishment expenses of a pit run on the same, whether few or many coals are won. It is to the interest, therefore, of owners of collieries who have a market to get as many coals as they possibly can away, and make a small margin of profit from the quantities produced. Best steam coals are in very good demand, and second-class steam collieries are doing very well, for the present at any rate.

The freight market has been slack. In fact, freights are as quiet as ever. Mediterranean business is rather worse; 4s. 3d. per ton is paid steamers to load coals for London; 4s. 4½d. Rochester. French rates are very low; 6s. per ton is all that is paid to Havre, and 5s. 9d. to Dieppe. Cronstadt rates are as low as ever, and one large boat is paid only £6 5s. per keel. This shows that shippers have pretty much their own way as regards freights; 8s. 3d. per ton was paid last week to small sailing ships to load fire-bricks for above bridge, London; 5s. 9d. per ton was the figure for small vessels to load gas coals to Lynn and the East coast.

The iron trade of the North of England has fallen into a dead, lifeless condition again, and prices are very poor. There seems little demand for any qualities of manufactured iron, and business is very depressed about Middlesbrough and the Leeside district. The chemical market was just a trifle stronger last week, and upon the limited business transacted there was a slight rise in the value of two or three articles. The general trade of the North of England is not improving at all, and there is great complaint of a want of foreign orders.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The annual meetings of the Scotch gas companies are now coming so "thick and fast" upon me, that I can scarcely get the whole of the notices referring to them put on record. There will doubtless be many additional meetings during the next few weeks. I shall proceed to make brief jottings regarding most of those which have been held within the last week or ten days.

At the annual meeting of the Blantyre Gas Company, Limited, which was held last Thursday, it was unanimously resolved to reduce the price of gas from 6s. 8d. to 5s. 10d. per 1000 cubic feet, the illuminating power of the gas being generally about 28 standard candles.

The annual general meeting of the Kelso Gas Company was held last Wednesday, when the accounts for the past year were submitted and approved of, and the usual dividend of 10 per cent. was ordered to be paid on and after the 2nd of July.

On Monday, the 25th of June, the annual meeting of the Auchterarder Gas Company was held. It was resolved to declare a dividend of 10 per cent.

The last meeting of the Coatbridge Gaslight Company, as at the time constituted, was held on Friday week, when the usual dividend of 10 per cent. was declared, and the sum of £500, being the balance of profits, was ordered to be divided amongst the shareholders. Votes of thanks were then awarded to the directors, and to Mr. Henry M'Lachlan, accountant, for the able manner in which he had conducted the parliamentary business of the company. The shareholders afterwards dined together, Mr. Henry M'Lachlan occupying the chair, and Mr. James Miller discharging the duties of croupier. During the course of the proceedings the utmost satisfaction was expressed with the manner in which the new works were being proceeded with, and the most sanguine hopes are entertained of the scheme being a complete success. The price of the gas is still to be continued at 3s. 9d. per 1000 cubic feet, the same rate as has been charged during the last two years.

In their annual report, which has just been issued, the directors of the Galashiels Gas Company recommend the payment of a dividend of 10 per cent., with a bonus of 2½ per cent., and that the sum of £414 should be carried to the credit of the next account. The directors also recommend that the share capital of the company should be increased by 200 shares, and the price of gas continued at 3s. 9d. per 1000 feet.

The Markinch Gaslight Company and the Auchtermuchty Gaslight Company have both declared dividends of 10 per cent. upon the past year's profits.

The Gourock Gas Company have reduced the price of gas to their consumers 5d. per 1000 cubic feet. The reduction, which will date back from the 1st of June, will now bring down the price to 5s. per 1000 feet, which is considered to be a very moderate rate for such a place as Gourock.

At a meeting of the directors of the Coupar Angus Gaslight Company held last Thursday, it was resolved to recommend to the shareholders to reduce the price of gas from 8s. 4d. to 7s. 6d. per 1000 feet, and that a dividend should be declared at the rate of 7½ per cent. per annum.

On Monday, the 25th of June, the annual meeting of the Forres Gaslight Company was held, when a dividend of 6½ per cent. was declared. It was also resolved to reduce the price of gas from 9s. 2d. to 8s. 4d. per 1000 cubic feet for the ensuing half year.

The annual general meeting of the Dunfermline Gaslight Company was held last Wednesday—Mr. Thomas Alexander, chairman of the company, presiding. Mr. W. Mackenzie, the manager and treasurer, read the directors report, which was as follows:—"A reduction in the price of gas to consumers, equivalent to 12½ per cent., has been in operation during all the past year. On account of general depression of trade, the increase in consumption of gas during the past year has not been in the same ratio as during the previous ten years. Your directors have, however, the satisfaction of intimating that there has been some increase of consumption during the period. Favourable contracts for coal were entered into, and in consequence, together with general successful management, the results of the year's business have been most satisfactory. In accordance with a plan recommended by the manager, a gradual renewal and extension of the system of mains is being made each year. This, the directors have reason to believe, is being attended with most beneficial and profitable results—a saving of nearly one per cent. on leakage or unaccounted-for gas has been made during the past year. An advance in price has taken place on first-class gas coals, and contracts have been made for the coming season's supply, at prices slightly in advance of those of last year. The works and apparatus are in good order, and in the most efficient state of repair. The directors have great pleasure in recommending that a dividend of 31s. 6d. per share, being at the rate of 9 per cent. per annum on the value of the stock, be declared." The report was adopted by the meeting, and the vacancies in the directorate filled up. It is especially worthy of mention in connexion with the meeting, that it was unanimously agreed to increase the salary of Mr. Mackenzie by £50 a year. That gentleman's professional brethren will doubtless be glad to congratulate him most heartily on receiving such a solid mark of the favour in which he is held by his directors, who are also to be congratulated on having such a worthy servant in their employment.

In a few days the gas storeage accommodation at the Broughty Ferry Gas-Works will be increased to 105,000 cubic feet, a large new gasholder, capable of containing 45,000 feet, being nearly completed. In 1854 the consumption of gas in the town was not more than 1,900,000 cubic feet; last year, however, it reached a total of 17,158,200 cubic feet. The selling price at present is 5s. per 1000 feet, with 5 per cent. discount for prompt payment, and the average illuminating power is equal to 29 standard candles.

In Dr. Wallace's report upon the quality of Glasgow gas for the week ending the 25th of June, it is shown that on one occasion the minimum illuminating power at West Street was down at 24·91 standard candles, which is certainly a most unusual circumstance. At the three stations where the testings were made the maximum ranged between 28·23 candles and 28·38 candles, while the average ranged from 26·61 to 26·87 candles.

At a special meeting of the Town Council of Lanark, held on Monday, the 25th of June, a new and comprehensive water-supply scheme was spoken of, the details of which, it was stated, would be mentioned at the next monthly meeting.

Complaints having been lodged with the Police Commissioners of Moffat that the supply of water was insufficient on account of great waste, that body have within the last few days held meetings on the subject. It was at first resolved to cut off the supply at the yards of the hotels and for building purposes, but, at a meeting held on Wednesday evening, it was agreed to concede four hours in the evening to the hotel-keepers, and two hours in the morning to the builders. It was stated at this meeting that the present supply of water was perfectly adequate if taken care of, there being a supply of 388,800 gallons per day, which was equal to 97 gallons per head of a population of 4000 persons—almost double the population of Moffat.

The expenditure in connexion with the Dundee water supply is estimated at £31,985, and, assuming the domestic, general, and special rates to remain unaltered, the revenue should be £32,184 9s. 6d., leaving a surplus of £199 9s. 6d. It is not proposed to increase the rates.

Last week's Glasgow pig iron market fluctuated somewhat in prices, and on Friday the closing quotations were—buyers 54s. 1½d one month, and 54s. cash; sellers very near. The fall on the week was 4½d.

No change of any importance has occurred in the coal market, and there is no prospect of any improvement.

Explosion of Gas in Liverpool.—Last Saturday morning a serious explosion of gas occurred in a house in Huskisson Street, Liverpool, occupied by a Mr. Tweedie. There being a strong smell of gas, a plumber was sent for, and he found the chandelier in the drawing-room drawn to its full extent, and the gas escaping. He imprudently struck a match, an explosion followed, and both the plumber and an old woman in the room at the time were severely burned. Nearly all the windows in the house were broken, and a good deal of the furniture damaged.

The Failure of Messrs. Blews.—The first meeting of creditors, of Mr. W. H. Maxwell Blews, of New Bartholomew Street, Birmingham West Bromwich, and Moscow (trading under the style or firm of William Blews and Son), bell and brass founder, chandelier and gas-fitting manufacturer, and gas-works contractor, was held at Birmingham on the 26th ult. The statement of affairs presented showed total liabilities amounting to £52,660, of which £25,036 were secured, and assets estimated at £18,515. A composition of 5s. in the pound, payable in four equal instalments extending over 12 months, was offered and unanimously accepted. Mr. Blews, in acknowledging the consideration shown to him by his creditors, said that, but for a most unfortunate but legitimate speculation in the Barbadoes Gas-Works, he should have been in a position to pay all claims in full.

Reductions in the Price of Gas.—The Gas Committee of the Leeds Corporation, at their meeting on the 25th ult., decided to reduce the price of gas from 3s. 3d. to 2s. 9d. per 1000 cubic feet, and, in addition, to allow an uniform discount of 2½ per cent. on all accounts paid within a month after the delivery of the demand note. At the Richmond Vestry meeting on the 26th ult., a letter was read from the gas company, stating that on and after the 1st inst. the price of gas would be reduced 3d. per 1000 feet, and the charge for public lamps would be £4 15s., instead of £5 per annum as formerly. The price of gas to private consumers is, therefore, now 4s. At Broadstairs the company have reduced the price from 5s. to 4s. 6d., which reduction is to take effect as from the 1st of April last. It is stated that the Kingston (Surrey) Company are about to reduce the price to 4s. The Gas-Works Committee of the Corporation of Bury, have resolved to recommend the council, at their next meeting, to reduce the price of gas to 3s. 4d. per 1000 feet. At Liverpool it is reported that a reduction of 3d. per 1000 will be made from the present time.

Metropolis Floods Prevention.—On Thursday last a deputation representing members of the Vestries and District Boards of Works for Lambeth, Wandsworth, Fulham, St. Saviour's, and St. Olave's had an interview with the Home Secretary in reference to the Thames Floods Prevention Bill. Sir Charles Dilke, M.P., and Sir James Watney introduced the deputation. Mr. George Hill, of Lambeth, said he was chairman of a conference which represented five riparian parishes who thought it was a great scandal to local self-government for things to remain as they were. During the inundation many people were engaged in raising funds to relieve the sufferers, and a deputation waited upon the Metropolitan Board of Works. The practical answer to their application was the production of a Bill founded upon a principle which everybody thought totally inequitable, and representations had been made to the Board accordingly. Although the Board had abandoned that measure, there was still the same urgent necessity for legislation. Mr. W. H. Lammin said they very much dreaded a repetition of the floods during the ensuing winter, and, as the Board of Works had done nothing, he suggested that the Government should introduce a short Bill at once. The Home Secretary replied that they had opened two questions which were rather different: The first was as to doing something to prevent the floods; and with that he was entirely with them in every possible way. The deputation had the decision of a committee of the House of Commons in their favour. Their report, however, had not yet been endorsed by the House. The Metropolitan Board might bring down the Bill, and have it discussed and argued in the House of Commons. That was the only way in which they could get a decision that would be binding. With regard to the question of delay, their object in coming to him was to get a discussion on the subject as soon as possible. He asked them to look at the question of time for a moment. It was absolutely impossible that the question could be discussed in the existing circumstances, for the Order Book of the House of Commons was completely crammed. The Government might bring in a Bill; the moment it was brought in there would be a notice of amendment, and it could not possibly come on till half-past twelve. If he were asked whether it would be possible for the Government to give their whole strength to the passing a measure of that kind at this period of the session, he must candidly assure them he thought it would be impossible. All he could promise them was to bring pressure on the Metropolitan Board of Works to give facilities for the measure being discussed. Further than that he could not go. The deputation thanked Mr. Cross and withdrew.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

2417.—Paul, E., Liverpool, "Improvements in and connected with pumps." June 22, 1877.

2419.—Beale, J., East Greenwich, London, "Improvements in the construction of rotary engines applicable for pumps or meters, or for the production of motive-power." June 22, 1877.

2420.—Colson, A., Birmingham, "Improvements in apparatus used in the manufacture of gas." June 22, 1877.

2428.—Clark, J., King's Cross, and Clark, F. W., Clapton, London, "An improved mode of and apparatus for purifying gas." June 22, 1877.

2447.—Puckett, W., Marlborough Street, London, "Improvements in gas apparatus for heating water or other liquids." June 23, 1877.

2469.—Gubbins, R. R., and Whitestone, J., Upper Thames Street London, "Improvements applicable to valves for gas, water, or steam pipes, and in the means of cleaning and grinding the working faces of such valves; part of which improvements are also applicable for protecting parts of other machines or apparatus from injury by oxidation." June 26, 1877.

2476.—Wallace, R. W., Battersea Park, and Claus, C. F., Great St. Helen's, London, "Improvements in the purification of gas, and the utilization of bye-products by the manufacture of secondary products therefrom." June 27, 1877.

2483.—Newton, W. E., Chancery Lane, London, "Improvements in pumps applicable to ships' pumps, and to pumps for draining mines, and for other purposes." A communication. June 27, 1877.

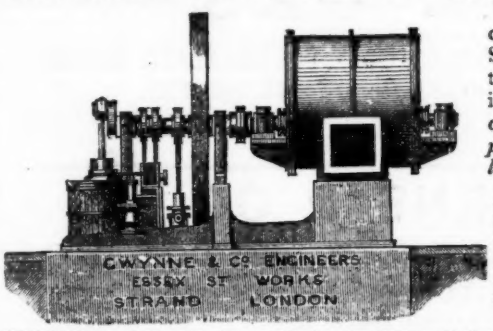
Share List of Metropolitan Gas and Water Companies.

(Corrected by Mr. F. N. Golding, Sun Court, Cornhill, from the latest Stock Exchange Quotations.)

Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.
	£	Gas Companies.	£ s. d	£ s. d	£
10000	20	Anglo-Romano . .	20 0 0	9 0 0	20—22
5000	20	Bahia (Limited). .	20 0 0	2 0 0	12—14
1000	20	Do., do., redeem.	20 0 0	2 0 0	24—26
1500	20	Do., 2nd pref. . .	20 0 0	7 10 0	21—22
40000	5	Bombay (Limited).	5 0 0	7 10 0	6¾—7¼
10000	5	Do., fourth issue.	4 0 0	7 0 0	5—5⅛
10000	20	British (Limited) .	20 0 0	10 0 0	41—43
7500	20	Cagliari (Limited).	20 0 0	5 0 0	118—119
5500001.	Sk.	*Commercial* . . .	100 0 0	10 0 0	208—213
70000	100	Do., 7 per cent. .	..	..	146—150
20000	20	Continental Union.	20 0 0	6 0 0	20-22 xd
10000	20	Do., new	12 10 0	6 0 0	par-1 xd
10000	20	Do., preference .	20 0 0	7 0 0	25-27 xd
75000	Sk.	*Crystal Palace District*	100 0 0	10 0 0	207—212
125000	Sk.	Do., 7 per cent. .	100 0 0	7 0 0	150—155
50000	Sk.	Do., preference .	100 0 0	6 0 0	135—140
23405	10	European (Limited)	10 0 0	10 0 0	18½—19½
12000	10	Do., new shares.	7 10 0	10 0 0	6—8
35406	10	Do., new shares .	5 0 0	10 0 0	4⅜—5¼pm
3797770l	Sk.	*Gaslight & Coke* A.	100 0 0	10 0 0	207—210
1000001.	Sk.	Do. B.	100 0 0	4 0 0	85—90
50000	10	Do. 5 per ct. pref. conv., 4th issue.	6 0 0	5 0 0	7⅛—8¼pm
50000	10	Do. do., 5th do. .	2 0 0	5 0 0	7—8 pm.
2000001.	Sk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	225—235
800000l.	,,	Do. D do. do. .	100 0 0	10 0 0	225—235
165000l.	,,	Do. E do. do. .	100 0 0	10 0 0	225—235
30000l.	,,	Do. F 5 do. do. .	100 0 0	5 0 0	114—116
60000l.	,,	Do. G 7½ do. do. .	100 0 0	7 10 0	158—163
13000001	,,	Do. H	100 0 0	7 0 0	148—151
6300	5	Georgetown, Guiana	5 0 0	5 0 0	..
5800	10	Hong Kong (Lim.)	10 0 0	10 0 0	18—20
56000	50	*Imprl. Continental*	45 15 0	9 10 0	94—96
2500000l.	Sk.	*London*	100 0 0	10 0 0	208—213
1500000l.	Sk.	Do., 1st pref. . .	100 0 0	6 0 0	138—143
14450	Sk.	Do., 2nd pref. . .	100 0 0	6 0 0	115—120
4350	Sk.	Do., 3rd pref. . .	100 0 0	6 0 0	115—120
7622	25	Do., A shares . .	12 10 0	6 0 0	34—36
268051.	All	Do., Debent. stk.	100 0 0	5l. & 6l.	..
15000	5	Malta and Mediterranean (Limited).	5 0 0	2 0 0	2—3 xd.
6000	5	Do., preference .	5 0 0	7 10 0	5—5⅛
		Mauritius (Limited)	2 0 0	..	⅛—1
25000	20	Monte Video (Lim.)	20 0 0	8 0 0	18¼—19¼
8000	10	Nictheroy, Brazil (Limited)	10 0 0	3 0 0	..
30000	5	Oriental (Calcutta).	5 0 0	9 10 0	7⅞—8¼
30000	5	Do., new shares .	3 0 0	9 10 0	1¾—2¼pm
10000	5	Ottoman (Limited).	5 0 0	3 0 0	2—3
17500	10	Pará (Limited) . .	10 0 0	7 0 0	5—6
27000	20	*Phœnix*	20 0 0	10 0 0	41—43
3600000l.	100	Do., new	60 0 0	7 10 0	104—109
1440000l.	Sk.	Do., capitalized .	100 0 0	5 0 0	106—112
		Do., new, 1876. .	..	..	17-18pm
36000	20	Rio de Janeiro (L.)	20 0 0	10 0 0	31—35
7359	5	Singapore (Limited)	5 0 0	7 10 0	5¼—5⅞
2000	5	Do., preference .	5 0 0	7 10 0	5¾—6¼
1500	32½	Shanghai	32 10 0	12 0 0	30—32
4000	50	*South Metropolitan*	50 0 0	10 0 0	106—109
4000	12½	Do.	12 10 0	10 0 0	26—28
20000	12½	Do., new shares .	10 10 0	10 0 0	12¼—13¼
		Surrey Consumers.	10 0 0	10 0 0	20—22
10000	10	Do., new	8 0 0	10 0 0	8¼—9¼
9000	4	United General . .	4 0 0	2 10 0	3—3½
		Water Companies.			
12000	100	Chelsea	100 0 0	6 0 0	145-8 xd
1800000	100	East London . . .	100 0 0	6 0 0	152-5 xd
8000	50	Grand Junction . .	50 0 0	5 0 0	72—75
5840	25	Do., ¼ shares . .	25 0 0	5 0 0	36—37
2160	25	Do., new ditto; max. div., 7½ p.c.	25 0 0	5 0 0	31—33
547960	100	Kent	100 0 0	8 0 0	194—198
970	100	Lambeth	100 0 0	6 5 0	145—150
1161	100	Do., max., 7½ p.c.	100 0 0	6 5 0	142—147
442	100	New River	100 0 0	7 0 0	320—330
4475	100	Do.	70 0 0	7 0 0	270—300
400000	100	Do., deb. sk., 4 p.c.	100 0 0	4 0 0	103—105
3036	100	Southwrk. & Vauxh.	100 0 0	4 0 0	110—113
1296	100	Do., pref. stock .	100 0 0	5 0 0	113—116
	100	Do., D shares . .	100 0 0	4 0 0	108—110
		Do., 4½ preference	100 0 0	4 10 0	106—108
		Do., new ordinary	..	4 10 0	..
1600	100	Do., new ord. No. 1	40 0 0	4 10 0	106—108
12172	61	West Middlesex . .	61 0 0	6l. p.sh.	132—134

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

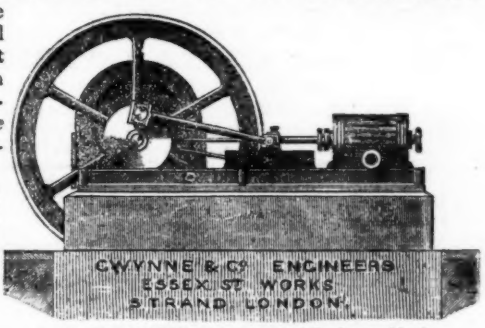
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

G. & Co. are now making 6 Sets Exhausters and Engines for 105,000 cubic feet per hour, 3 Sets 180,000 Exhausters and Engines with many others of all Sizes.

NOTICE OF REMOVAL.

D. BRUCE PEEBLES & CO.

Beg to announce that they have REMOVED to their New Premises,

TAY WORKS, BONNINGTON, EDINBURGH,

To which all communications should now be addressed.

May 30, 1877.

WANTED, by a Working Manager of a Gas-Work, a SITUATION. Can do main and service laying, meter-fixing, setting of retorts, clay or iron, on an improved principle, inside or outside fittings of any description. Twelve years testimonials. Abroad preferred.
Address No. 380, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, small Gas-Works on Lease, for 7, 14, or 21 years. Annual make from two to six millions; a per centage upon capital to be paid as rent.
Advertiser is also open to purchase small gas-works.
Address No. 381, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a situation as Working Manager, Inspector, or Collector, by an energetic practical man of good address, fully conversant with the manufacture and distribution of gas, main and service laying; has also a thorough knowledge of consumers fittings, &c. First-class testimonials and references.
Address J. L., 10, High Street, Camden Town.

WANTED, for a country Gas-Work, a MAN to take the day work in the retort and purifying house, who can lay a main or service occasionally, and keep the apparatus generally in good working order. He would reside on the works, and is required to have good character and experience.
Apply to the Secretary, Gas Company, Buckingham.

WANTED, for two small Gas-Works, each producing about 3,000,000 cubic feet per annum, a WORKING MANAGER, who can lay mains and services, fix and attend to meters, &c. House, fire, and light free.
Apply, stating wages required and particulars of former employment, to Mr. John Eunson, Gas-Works, Northampton.

TO GAS COMPANIES.

WE beg to call attention to our special STEATITE BURNERS for Street Lamps. Sample gross 8s. Quotations for quantities.
Messrs. Tindall and Telling, Gas Apparatus Works, 74, Wynford Road, Penton Street, London, N.

THE RATING OF GAS AND WATER WORKS.

A Gentleman of experience in the Rating of Properties of Public Companies is willing to undertake, in the interests of Companies, the Valuation of Gas and Water Works for Rating purposes.
Address, in first instance, No. 367, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

TO BE DISPOSED OF—A Gas-Meter and GAS-COOKING APPARATUS MANUFACTORY (excellent premises) to which a Heavy Ironmongery trade might be added. Proprietor retiring.
Address R., Mr. Fenton, 1, Commercial Street, Leeds.

READING GAS COMPANY.

FOR SALE, as they now stand, and at any reasonable price, as the ground upon which they stand is wanted, four 12-ft. square Cast-Iron PURIFIERS, with centre-valve and connexions, grids, tee bars, &c., complete.
Apply to Mr. E. Baker, Engineer, Gas-Works, Reading.

In the Press, and will be shortly published, price 5s., by post 5s. 3d., cloth, 8vo., gilt lettered,

SULPHUR COMPOUNDS IN GAS.

A full Report of the Evidence given before the Select Committee of the House of Commons on the Bills of The Gaslight and Coke Company and the Crystal Palace District Gas Company in the present Session.

As the number of Copies printed is very limited, early application to the Publisher is necessary, to prevent disappointment.

LONDON:
WILLIAM B. KING, 11, BOLT COURT, FLEET ST.

NORTH BRITISH ASSOCIATION of GAS MANAGERS.

The SIXTEENTH ANNUAL GENERAL MEETING of the Members of this Association will be held in

THE UNION HALL, STIRLING,

On FRIDAY, July 13, 1877.

A. MACPHERSON, Esq., PRESIDENT,
Will occupy the Chair.

PROCEEDINGS.

BUSINESS MEETING.

Chair to be taken at Half-past Ten A.M.

Reading of Minutes.
Admission of New Members, &c.
PRESIDENT'S INAUGURAL ADDRESS.
Auditor's Report.
Election of Office-Bearers.

LIST OF PAPERS AND COMMUNICATIONS.

"Note of a Mechanical Difficulty with Coal Tar, and Method of Surmounting it." By Mr. JOHN REID, of Leith.

"The Condensation and Treatment of Gases by the 'Aitken-Young' Process." By Mr. ROBERT MITCHELL, of Coatbridge.

"The Causes affecting the Quantity of Carbon deposited in Retorts." By Mr. WILLIAM YOUNG, of Clippens, Paisley.

"Internal Gas-Fittings." By Mr. J. HALL, of St. Andrews.

LECTURE.

At Three o'clock, a Lecture will be delivered by Dr. WILLIAM WALLACE, F.R.S.E., Analytical Chemist, Glasgow, on "The Bunsen Burner."

DINNER.

At Half-past Four o'clock, the Members and Friends will Dine together in the "Golden Lion" Hotel, Stirling. Tickets for the Dinner, 5s. each, may be had from the Secretary; early application for which is specially requested.

WM. MACKENZIE, Sec.
Gas-Works, Dunfermline, June 29, 1877.

FOR SALE—A Set of Four Purifiers, 8 ft. by 6 ft., with covers, grids, centre-valve, and 6-in. connexions complete.
Apply to J. GILL, Gas-Works, BRIDGNORTH.

FOR SALE—One New 6-inch Centre-VALVE, by Messrs. C. and W. Walker (patent), with service connexions; not been fixed.
One STATION-METER, by Messrs. J. and J. Braddock, Oldham, for 6-inch connexions, to pass 8000 feet per hour. Has been in work five years; in first-class condition.
For particulars apply to HENRY CLARK, Secretary, Gas Company, Maldon, ESSEX.

GASHOLDER FOR SALE.

ONE Telescopic Gasholder, 70 feet by 20 feet, complete, with cast-iron tank, columns, girders, and inlet and outlet pipes, valves, &c., of modern construction. In first-class condition, and made by Messrs. Pigott and Co., of Birmingham.
To be seen at work at the Gas-Works, Birkenhead.
Cause of removal to make room for extensions.
To be sold a bargain, taken down, and re-erected ready for work.
For particulars, apply to Messrs. ASHMORE AND WHILE, STOCKTON-ON-TEES, or to view to Mr. CALLOW, Gas Engineer, BIRKENHEAD.

TO TAR DISTILLERS.

THE Directors of the Dover Gaslight Company are prepared to receive TENDERS for the purchase of the TAR produced at the Gas-Works, Dover.
Tenders to be sent in before Saturday, the 21st of July inst.
For information as to terms and conditions, apply to the undersigned.

R. H. JONES, General Manager.
Dover, July 2, 1877.

TO IRONFOUNDERS AND CONTRACTORS.

THE Directors of the Rhyl Gaslight and Coke Company, Limited, are prepared to receive TENDERS for the construction and erection of Retort Fittings, Condenser, Scrubber, four Purifiers, 10 ft. square, Valves, and Connexions.
Plans and specifications may be seen on application to the Engineer, Mr. F. J. Collingwood, Rhyl, or at the Offices of the Company, High Street, Rhyl.
Sealed tenders to be addressed to the Chairman, Gas Company, Rhyl, and delivered not later than the 18th inst., endorsed "Tender for Ironwork."
The Directors do not bind themselves to accept any tender.

MILES R. PARTINGTON, Secretary.
July 2, 1877.

GAS-WORKS, LOW BRIDGE, KEIGHLEY.

MESSRS. WEATHERHEAD and SKAIFE are honoured with instructions from the Gas Committee of the Keighley Local Board of Health to Catalogue and SELL BY AUCTION, on Thursday, the 5th day of July, 1877, on the above Works,
ALL the SURPLUS GAS PLANT & APPARATUS, consisting of 140 mouthpieces, 18 in. by 15 in., hydraulics, dip-pipes, exhauster; tar, liquor, and water pumps, scrubber, purifiers, station-meter, 60 tons of iron, boiler for storing tar, gasholder, 6 ft. diameter, single-lift, complete, and other apparatus, particulars of which will be given in descriptive catalogue in due course, and may be obtained from the AUCTIONEERS.
Sale at Eleven o'clock a.m.
Auctioneers Offices, Low Street, Keighley.

THE BLAENAU FESTINIOG GAS COMPANY, LIMITED.

GASHOLDER.

THE Directors of this Company are prepared to receive TENDERS for a GASHOLDER, 30 ft. diameter, 10 ft. deep, put up at the Works, and complete with columns, wheels, chains, weights; also inlet and outlet pipes, valves, and connecting-pipes, inlet and outlet of present gasholder.
Any further information may be obtained on application to the Secretary.
Tenders are to be sent in on or before the 18th day of July next, endorsed "Tender for Gasholder," and addressed to the Secretary.
The Directors do not bind themselves to accept the lowest or any tender.

J. CADWALADR, Fourcrosses, R.S.O., *Viâ* Carnarvon.
June 26, 1877.

TO TAR DISTILLERS, &c.

THE Directors of the Kingston-upon-Thames Gas Company are prepared to receive TENDERS for the surplus TAR produced at their works at Kingston, from the date hereof to June 30, 1878. Quantity about 80,000 gallons, more or less. Tenders to be at per gallon, f.o.b. the Contractor's barge at Kingston.
Further particulars may be obtained from Mr. Packham, Manager, at the Works, where a copy of contract may be seen.
Tenders to be sent to Mr. W. A. Fricker, Secretary, Gas Offices, Church Street, Kingston, on or before the 31st day of July, endorsed "Tender for Tar."
The Company do not pledge themselves to accept the highest or any tender.

By order,
W. A. FRICKER, Secretary.
Gas Offices, Kingston, June 30, 1877.

LEEK IMPROVEMENT ACT, 1855.

CONTRACT FOR GAS COAL.

THE Leek Improvement Commissioners invite TENDERS for a supply of Best GAS COAL to their Works for One, Two, or Three years, from the 1st of July, 1877, delivered free at the Leek Railway Station or Canal Wharf at such times and in such quantities as may be required by their Manager for the time being, or by the undersigned.
Sealed tenders addressed to the Chairman of the Gas Committee, Commissioners Offices, Leek, must be received before Four o'clock p.m. on Monday, the 9th of July next.
The Commissioners do not bind themselves to accept the lowest or any tender.
Further particulars may be obtained from
C. HENSHAW, Clerk to the Commissioners.
Russell Street, Leek, June 15, 1877.

Now ready, price One Shilling, No. 8 *(to be continued Monthly) of*

A TREATISE ON THE SCIENCE & PRACTICE

OF THE

Manufacture and Distribution

OF

COAL GAS.

LONDON: WILLIAM B. KING, 11, BOLT COURT, FLEET STREET,
OR OF ANY BOOKSELLER IN TOWN OR COUNTRY.

For the convenience of persons resident in remote districts, arrangements have been made by the Publisher to forward the "Treatise" by Post, securely packed, at the cost of 1s. 2d. Monthly, or 7s. for the Half Year.

S. OWENS & CO.,

WHITEFRIARS STREET, LONDON, E.C.,

HYDRAULIC ENGINEERS,

AND MANUFACTURERS OF

PUMPING MACHINERY of every Description.

SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN OF

BLAKE'S PATENT STEAM-PUMPS,

More than 10,000 in use,

ESPECIALLY ADAPTED FOR USE IN GAS AND CHEMICAL WORKS, FOR PUMPING TAR, WATER, AMMONIACAL LIQUOR, ACIDS, &c.

The following are some of the prominent advantages of the BLAKE PUMP:—

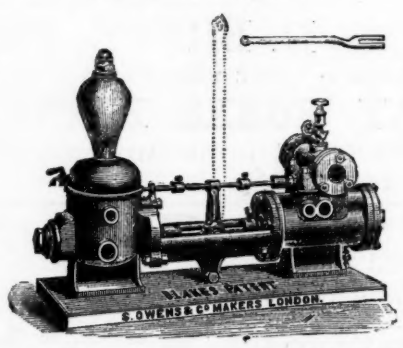
It will start at any point of stroke.

It has no dead point.

It works fast or slow, with the same certainty of action.

It is economical. Has a lead on the slide-valve.

It is compact and durable.



It is interchangeable in all its working parts.

It will deliver more water than any other pump.

It is made of best materials in the most workmanlike manner.

Can be worked at 20 strokes per hour, or 200 strokes per minute.

This Illustration represents Boiler-Feed Pumps, Sizes Nos. 1, 2, *and* 3, *with Hand Lever for working Pump when Steam is not available.*

SOLE MANUFACTURERS OF

MANN & OWENS
IMPROVED PATENT GAS-VALVES.

PRICED LISTS AND FULL PARTICULARS FURNISHED ON APPLICATION.

Just Published, Price 2s. 6d.,

COMMON SENSE FOR GAS USERS,

Being a Catechism of Gas Lighting for Householders, Gas-Fitters, Architects, Engineers, Millowners, &c.

By ROBERT WILSON, C.E.

CROSBY, LOCKWOOD & CO., 7, STATIONERS HALL COURT, E.C.

Now ready.

THE GAS & WATER COMPANIES DIRECTORY FOR THE YEAR 1877,

EDITED BY

CHARLES W. HASTINGS,

8, BUCKINGHAM STREET, ADELPHI, LONDON, W.C.

THIS WORK IS UNDER THE PATRONAGE OF ALL THE LEADING GAS & WATER ENGINEERS AND SECRETARIES OF THE METROPOLITAN & PROVINCIAL COMPANIES.

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BAILES & HALLSWORTH,

CONTRACTORS FOR THE

PURIFICATION OF COAL GAS,

BY THEIR

PATENT OXIDE OF IRON COMPOUND.

The material is in use at most of the principal Gas-Works in Yorkshire and elsewhere. It contains considerably less moisture than natural Oxide of Iron. It is much cheaper and more efficient as a purifying agent.

B. & H. are purchasers of Spent Oxide, or will take Spent in exchange for New Material.

FOR SAMPLES AND TERMS, ADDRESS—

BAILES & HALLSWORTH, COPPERAS WORKS, ARMLEY, LEEDS.

J. & J. BRADDOCK,

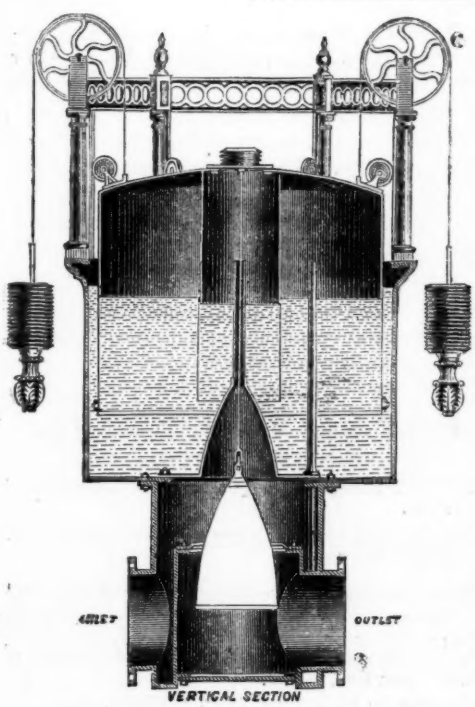
GLOBE METER-WORKS,

OLDHAM,

Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

THE Newport (Mon.) Gas Company have FOR SALE the following PLANT at their Works, Newport, Mon.:—

Two Cylindrical Boilers, 13 ft. by 4 ft., with fittings complete, and steam-pipes to engines.

Two Horizontal Engines, each cylinder 9½ in. diameter, and stroke of each 1 ft. 6 in.

Two Beale's Exhausters, made to pass 20,000 cubic feet per hour each, with regulators and bye-pass.

The above are in good order, have been working during the past winter, and are now offered for sale because larger ones have been fixed.

Particulars and prices given for the whole or a portion of the Plant on application to the undersigned.

They can be seen at the Works, Mill Street, Newport, Mon.

THOMAS CANNING, Engineer.

May 18, 1877.

AMMONIACAL LIQUOR AND TAR.

THE Directors of the Peterborough Gas Company invite TENDERS for the purchase of the AMMONIACAL LIQUOR and surplus TAR produced at their Works for a period of one year, commencing with July 1, 1877.

Tenders to be sent in, addressed to the Manager, Gas-Works, Peterborough, on or before the 10th of July next.

By order of the Directors,

JNO. GRAVES, Secretary.

Peterborough, June 19, 1877.

TO CONTRACTORS, GASHOLDER-TANK BUILDERS, AND OTHERS.

THE Directors of the Swindon Gaslight and Coke Company are prepared to receive TENDERS for the construction of a GASHOLDER-TANK in Brick at their Works.

Drawings may be seen and specifications and full particulars obtained on application to Mr. Hunt, Engineer and Manager, the Works, Swindon, Wilts.

Tenders are to be sent in on or before Thursday, the 12th day of July next, endorsed "Tender for Gasholder-Tank," and addressed to the Chairman.

The Board do not bind themselves to accept the lowest or any tender.

HENRY HUNT, Engineer.

June 28, 1877.

PAMPHLET ON GAS.

COOKING AND HEATING.

HINTS ON GAS-BURNERS, &c.

For GAS COMPANIES to distribute to their Gas Consumers.

Specimen Copy by post Threepence, from the Author,

MAGNUS OHREN, Gas-Works, Sydenham, S.E.

T. NEWBIGGING,

CONSULTING GAS ENGINEER,

5, NORFOLK STREET, MANCHESTER.

HENRY LYON,

ENGINEER,

AND

CONSULTING GAS ENGINEER,

BARTON HOUSE, opposite BARTON ARCADE,

DEANSGATE, MANCHESTER.

ALFRED LASS,

SPECIAL ACCOUNTANT FOR GAS COMPANIES,

30, GRACECHURCH STREET, LONDON.

Accounts analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by A. L. to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, and have been universally approved.

The above forms are registered.

Water Companies Accounts also prepared and adjusted.

CONSULTATIONS.

PATRONIZED BY THE ROYAL ARSENAL, WOOLWICH.

FERGUSON, Builder and Contractor. Kite method of Repairing Church Spires and High Chimneys. Chimneys straightened, pointed, and hooped. Old Chimneys pulled down by a process requiring no scaffolding or stoppage of work, by competent workmen, under personal supervision. For Lightning Conductors—cheapness and method of fixing—apply to C. R. FERGUSON, 12, Canal Road, MILE END.

JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER

AND

CANNEL COAL FACTOR.

30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GURST AND CHRIMES, ROTHERHAM.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.

For prices, &c., apply to the Manufacturers, Messrs. GURST AND CHRIMES, Foundry and Brass Works, ROTHERHAM.

CATHELS'S Improved Retort-Settings. Guaranteed to heat and wear well, with great economy of Fuel.

Coloured lithograph copies of Working Drawings of Beds of One to Seven Retorts (so clearly arranged and fully shown as to be easily understood by any retort setter or bricklayer) having been made of these valuable settings, they can now be supplied with detailed Specification immediately on receipt of orders.

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HEBBURN MAIN GAS COALS.

T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,524 cubic feet per ton of 14½-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

THE TYNE COAL COMPANY, LIMITED, OWNERS.
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HOPKINS, GILKES, & CO.,
LIMITED,
MIDDLESBOROUGH,
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Castings for Gas-Works of every description.
EXHAUSTERS.
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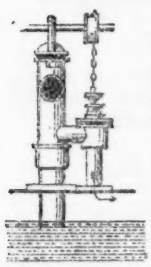

Produces from 10 to 20 per cent. more gas of higher illuminating power.
Prevents the deposit of carbon.
Retorts last much longer.
Charges work off quicker.
This simple invention has been in use in many works for the last six months, with the above results.

PRICE 2 GUINEAS EACH.

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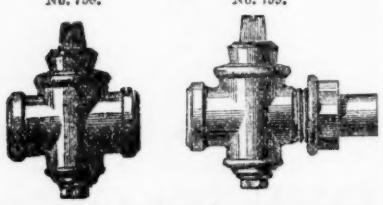
WITH PATENT WHITE METAL PLUGS.

TRADE (L) MARK.

No. 758. No. 759.



The bodies of these Taps are made of iron, black or galvanized, and the plugs of patent metal. They are warranted not to set fast or corrode, as do Iron or Brass Cocks; will always work easily; are strong, well made, durable; of little or no intrinsic value, and therefore not likely to be stolen; and the prices as stated below are (especially upon the larger sizes) fully 50 per cent. less than Brass Cocks.

	½	¾	1	1¼	1½	2-inch.
No. 758, with inside screws for iron pipe, black	2/0	3/0	4/4	6/6	7/6	12/0 each.
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N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

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Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,
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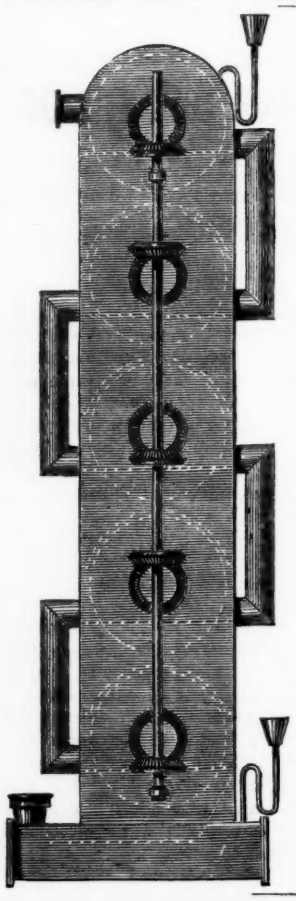
COMBINED WASHER AND SCRUBBER.



TESTIMONY OF ITS ACTION.

The Gas-Works, St. Albans,
April 27, 1877.

DEAR SIR,

Your Brush Scrubber has been in action here for four months.

It removes the whole of the ammonia from the gas, so that it will not discolour moistened turmeric paper.

The brushes cause no appreciable increase of pressure, and there is no repumping of liquor. Clear water run in at top, issues from the bottom fit to proceed to the sulphate-house.

It performs its work more efficiently than the tower scrubber I have, while only about half the height, and not one-fourth its weight or capacity.

My purifiers also last much longer before they are foul than they did previously.

I am, yours truly,
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STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES.

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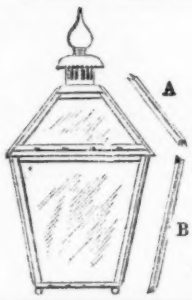

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This Meter supplies a want long felt, by putting an end to the loss sustained by Gas Companies through the overworking of their Meters.

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Established 1830.

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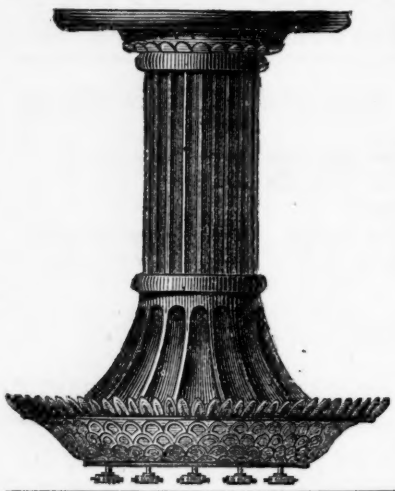

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With Regulating Valves to obviate down draught.

MEDIÆVAL & OTHER GAS-FITTINGS

For Churches and Domestic Use.

ARCHITECTS' OWN DESIGNS WORKED OUT.

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HENRY GREENE AND SON, 155, Cannon Street, London, Sole Agents for Great Britain, Ireland, and Colonies, of Brönner's Improvements in Gas Lighting, beg to inform the public that on the 13th of January, 1876, Julius Brönner obtained an injunction in the Court of Session, Scotland, against Donald M'Vean, Gas-Fitter, 14, Newton Street, Glasgow, prohibiting him from in any way advertising or offering for sale as Brönner's Burners, any Burner not manufactured by Julius Brönner, or from in any way inducing the public to believe that the said Donald M'Vean sells or keeps for sale Brönner's Burners, manufactured by Julius Brönner, while such is not the case.

Also that on the 9th of November, 1875, he obtained injunction in the same Court, and in the same terms, against R. M. Brechin and Co., 46, North Hanover Street, Edinburgh.

Also that on the 20th of April, 1875, in a suit in Chancery, before Vice-Chancellor Malins, number 1874, B 365, he obtained injunction against another defendant, in the same terms and on similar grounds.

WEST'S GAS IMPROVEMENT COMPANY, LIMITED,

ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

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And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

The advantages attending its use are—

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A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to the Consulting Engineer, R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W., or to the Engineer and Analyst, F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

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The Faced Valves, as made by the Patentees, continue to give great satisfaction, and they are being used extensively by many of the best gas engineers of the day.

They are more easily repaired than any other kind of Valve in use, and can be re-ground in a few hours without removal, and made perfectly gas-tight.

References can be given to many Engineers of high standing, who will testify as to the favour in which they are held.

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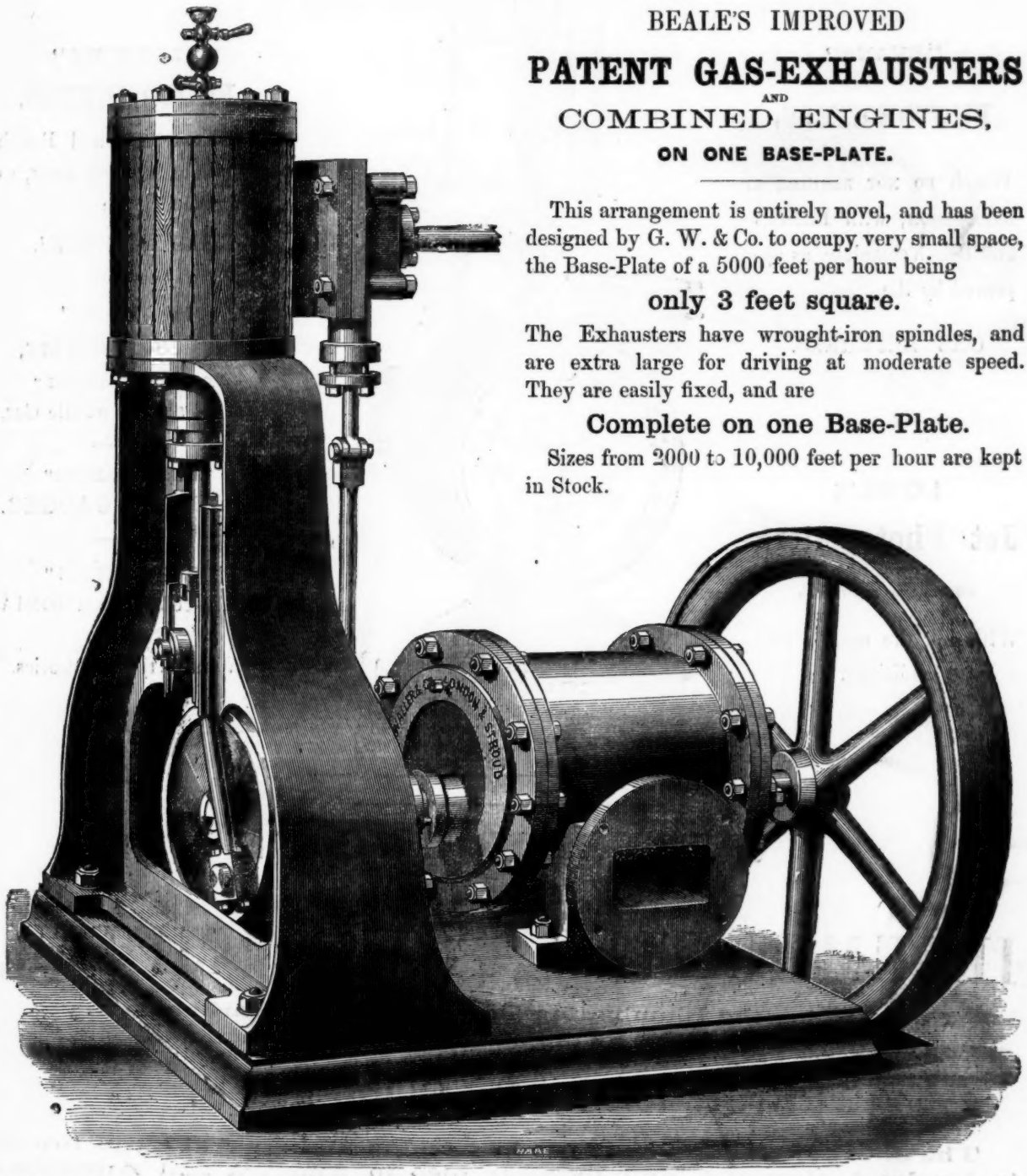

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COMBINED ENGINES,
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This arrangement is entirely novel, and has been designed by G. W. & Co. to occupy very small space, the Base-Plate of a 5000 feet per hour being

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The Exhausters have wrought-iron spindles, and are extra large for driving at moderate speed. They are easily fixed, and are

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ILLUMINATING POWER METER,

For showing the Illuminating Power of Gas in Parliamentary Sperm Candles, by the observation of one minute.

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It is to be particularly noted that the im-portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

They are, in all cases, constructed under guarantees to perfectly perform their work. They are now extensively used in the largest gas-works of London and the chief cities of Europe, the number in use exceeds **one hundred,** and their perfect efficiency and profit to a gas company have been fully established with every variety of coal used in Europe. References can be given to the largest gas-works in Europe.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, re-quiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

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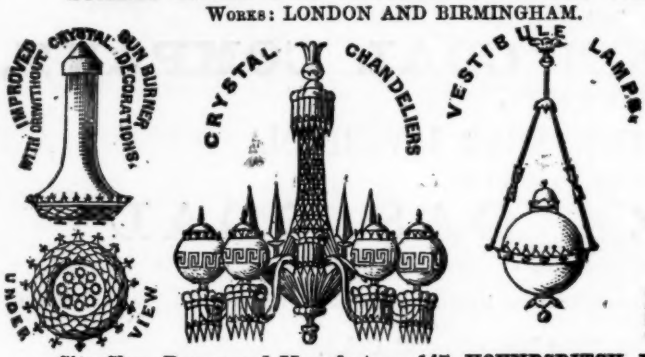

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GAS REFLECTORS In Silver and Glass

GAS NIBS AND **BURNERS** Of every description.

Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1876, are now complete.

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SOLE AGENT FOR

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STOURBRIDGE FIRE-BRICKS, RETORTS, CLAY, &c.

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Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

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Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

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Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full Analyses on application.

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POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

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Established 1840.

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Supply to any Railway Station or export Best Wigan Arley Gas Coal and Nuts; best qualities of the Derbyshire, Yorkshire, and North Staffordshire Gas Coals and Nuts; also the best descriptions of Lancashire, Welsh, Scotch, and other Cannel.

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PORTABLE PIPE SCREWING MACHINE,

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

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ALBERT GAS COAL.

THE DERBYSHIRE

SILKSTONE COAL COMPANY,

LIMITED,

CAN OFFER A

GAS COAL

Of superior quality, delivered in trucks at any Railway Station in England, or shipped on board at Hull, Grimsby Docks, or Barrow-in-Furness.

Purified gas per ton of coal in cubic feet (average)	**10,262**
Illuminating power in candles	**15·86**
Weight of coke in lbs. per ton of coal	**1,502**

ANALYSIS AND PRICES ON APPLICATION TO

Mr. EDMUND TAYLOR, Secretary,

ALBERT COLLIERY, NEWBOLD, NEAR CHESTERFIELD.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

THE

WIGAN & WHISTON COAL COMPANY,

LIMITED,

(COLLIERIES—PRESCOT, NEAR LIVERPOOL)

Are now prepared to supply their

RUSHY PARK GAS COAL,

Either to Gas-Works in England or Wales, or for Shipment, at Runcorn, Garston, Birkenhead, or Liverpool.

This Coal is of superior quality, and yields in practical working over 10,000 cubic feet of Purified Gas per ton, with an Illuminating Power of 17½ candles.

One Ton of Coal yields 1441 lbs. of good Coke.

For prices, &c., apply either direct to the Colliery or to the Company's Office,

195, FALKNER STREET, LIVERPOOL.

SILKSTONE GAS COAL

AND

LANCASHIRE AND MIDLAND CANNEL.

EMOR G. WRIGLEY, Merchant,

Having made arrangements with four large Collieries for the exclusive sale of their GAS COAL and CANNEL, can offer to Gas Companies large quantities, for delivery over one or two years, at exceedingly low prices. His REAL OLD SILKSTONE GAS COAL will give, in regular work, 10,200 feet 16·6 candle gas and 13 cwt. superior coke; and a WIGAN CANNEL 11,375 feet 21·75 candle gas and 12 cwt. superior coke.

PRICES AND ANALYSIS WILL BE FORWARDED TO ANY PART ON APPLICATION TO THE CHIEF OFFICE,

120a, STAMFORD STREET, ASHTON-UNDER-LYNE.

1862.

PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.

CLASS II.

This Paint having been in general use over fifteen years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (30s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

The following Gas Companies in London have used the Paint for years—viz., The Gaslight and Coke, Imperial, Independent, City of London, Commercial, London, and Surrey Consumers.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt., as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints, for which purpose it is superior to White Lead.

SPECIAL DRIERS FOR ANTIMONY PAINT SUPPLIED.

NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

Warrington Gaslight and Coke Company,
Offices, Mersey Street, Warrington, April 23, 1877.

Messrs. NEWTON, CHAMBERS, AND CO.,

Gentlemen,

After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

The average of Nine samples gives a yield of 12,500 cubic feet of 15½ Candle Gas, being equivalent to 664 lbs. of sperm per ton, and 1420 lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

Yours truly,

JAMES PATERSON.

Full particulars will be sent on application to us—address as above.

NEW PATENT WET GAS-METER,

THE "RELIANCE,"

MANUFACTURED BY THE

GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

Accuracy is obtained by subjecting the whole of the water which determines the measuring chambers of the drum to one uniform even pressure, and so prevents unequal displacements of the water-line.

The "RELIANCE" METER has been tested by several of the most experienced official meter inspectors. Copies of their reports may be obtained on application to the

GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON.

HARRIS & PEARSON,

FIRE-CLAY AND BRICK WORKS, STOURBRIDGE.

GAS-RETORTS, LUMPS, TILES, & FIRE-BRICKS,

OF EVERY DESCRIPTION.

A LARGE ASSORTMENT OF GAS-RETORTS IN STOCK.

STOCK FOR EXPORT READY AT THE WORKS, AND AT ELLESMERE PORT.

R. LAIDLAW AND SON,

EDINBURGH AND GLASGOW,

SOLE MAKERS OF

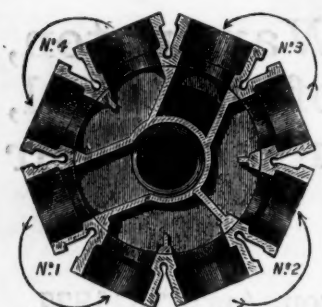
PATENT

RECESSED CONE CENTRE-VALVES,

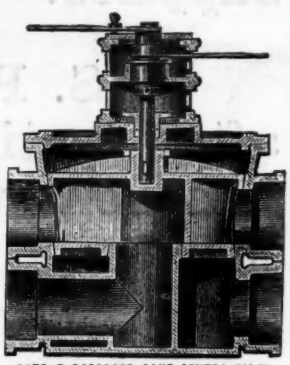
Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Plan.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Elevation.

LONDON OFFICE: 106, CANNON STREET.

D. HULETT & CO.

Invite the attention of Gas Companies, Corporations, and others to their

PATENT STREET LAMPS,

Which are so constructed that neither putty nor other materials are required to secure the glass. No hacking out of old putty, which frequently destroys the frames. A new pane of glass can be inserted in two or three minutes by any inexperienced person, the glass being secured by a hinged flap and turn button.

PRICE 10s. each, net. Special quotations for large quantities.
Also made EXTRA STOUT recommended for its durability, PRICE 11s. 6d. each.

D. HULETT'S IMPROVED SERVICE CLEANSER,

By the use of which stoppages in service and other pipes are freed from naphthaline and other obstructions in a few minutes. PRICE 73s. net.

HULETT'S PATENT MERCURIAL REGULATOR,

For inserting in mains, to prevent the excess of pressure in high ground, or other elevated positions.

PATENTEES OF IMPROVED WET AND DRY GAS-METERS.

Makers of all kinds of Pressure-Gauges, Gaseliers, and every kind of Gas-Fittings for the Trade.

GAS HEATING AND COOKING STOVES.

55 and 56, HIGH HOLBORN, LONDON.

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